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ABSTRACT

A study involving eight boys with autism and eight boys with Down syndrome (ages 6-10) with similar adaptive behavior levels used an ecological approach to study the in-depth structure of the behavior stream. Narrative records were collected and analyzed based on duration and frequency of behaviors. Each record was analyzed by marking the behavior stream into activity units (AUs), which are naturally occurring chunks of behavior from the perspective of the child that proceed in a constant psychological direction. Findings revealed that children with autism exhibited AUs of shorter duration and with less overlap. No differences in features related to the setting or in qualitative aspects of AUs were found. Children with autism were more likely to use physical mechanisms; children with Down syndrome used more gestures. Analysis of the duration of intention of AUs revealed that children spent similar amounts of time participating in all but two types of activities. Children with autism spent more time readying their environment and children with Down syndrome spent more time eating and drinking. Subcategory analysis revealed that children with autism were four times more likely to fail to respond. (Contains 165 references.) (Author/CR)

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Comparative Study of the Natural Habitat Behaviors of Children with Autism and Children with Down Syndrome: An Ecological Approach

By

Lisa Ann Ruble

Submitted to the faculty of the Graduate School
in partial fulfillment of the requirements
for the degree Doctor of Philosophy
in the School of Education,
Indiana University
October 1997

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Accepted by the Graduate Faculty, Indiana University, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Robert Davis, Ed.D.

October 24, 1997

This study is dedicated to the parents and professionals who work to make the lives of people with disabilities more fulfilled and to people with autism and people Down syndrome who continue to achieve.

"Never doubt that a small group of thoughtful committed citizens can change the world;
Indeed it's the only thing that ever has."

-Margaret Mead-

Acknowledgments

I met Nancy Dalrymple almost 20 years ago when my sister Leslie first received the benefits of Nancy's wisdom and care. Little did I know then how much influence Nancy would have on the rest of my life. She has taught me that individuals are powerful and responsible. Her ability to follow through without leaving a single question unanswered, issue undealt with, or family in need is exceptional. Inspiration comes from her ceaseless commitment to improve people's lives and her ability to focus on what is most important. Her influence continues to shape my goals for myself as a person, friend, and colleague.

Myrtle Scott first introduced me to the methods of ecological psychology in the context of child development. Through her teaching, a foundation of knowledge was laid, providing the critical skills necessary for this research. She encourages her students to think about data that others might dismiss as error, to be open to alternative methods of data collection and analysis, to take on the challenge of examining the role of the environment, and to build bridges between research and practice.

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After I made the decision to study psychology, Bob was one of the few professors to make an impression that extended well beyond professionalism. Providing a forum for people with disabilities to talk to his students demonstrated the power of self-advocacy, while his emphasis on social responsibility greatly enhanced the curriculum.

Sam allowed me to test my early ideas of social development research. His years of experience in special education are of great value and will continue to shape my thinking.

I was first introduced to autism by my sister Leslie. Leslie amazes me with her continual growth in understanding of the world. As I have learned from her these past 28 years, my admiration of my mother Linda Barton–the key to Leslie's success–has grown. My mom pushed for services long before they were mandated by law. Her energy, positive outlook, and sense of humor are extraordinary. Most of all she taught me the rewards from living a life based on values and that individuals certainly can make a difference.

How lucky I was to meet Jim Graham at start of my PhD program. His passion for learning is intense and contagious, often provoking the stimulation needed for endless hours of graduate work. I cherish Jim for his tenacity, childlike wonder of the world, and yearning to answer questions that most adults have lost the desire and awareness to ask.

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Abstract

A Comparative Study of Natural Habitat Behaviors of Children with Autism and Children with Down Syndrome: An Ecological Approach

Little is known about children with autism in their natural environment, or about children with autism who have more limited cognitive and verbal abilities. This study is the first to apply methods from ecological psychology to increase the understanding of autism. A better understanding of behavior that occurs in the natural habitat will aid diagnostic and assessment efforts and the identification of ecologically-relevant treatment variables. The ecological approach described by Scott (1980) was applied to study the in-depth structure of the behavior stream. Participants included 8 boys with autism and 8 boys with Down syndrome between the ages of 6 and 10 of similar adaptive behavior levels. Narrative records were collected and analyzed based on duration and frequency of behaviors. Each record was analyzed by marking the behavior stream into activity units (AUs), which are naturally occurring chunks of behavior from the perspective of the child and occurring along a constant psychological direction. Each AU was then coded. Findings based on the structure of the AUs revealed that children with autism exhibited AUs of shorter duration and with less overlap. No differences in features related to the setting or in qualitative aspects of AUs were found. Partners of children with Down syndrome were more likely to be rated as being involved with high duration as compared to those of children with autism. Children with autism were more likely to use physical mechanisms; children with Down syndrome used more gestures. Both groups of children spent most of their time playing and watching TV. Analysis of the duration of intention of AU revealed that children spent similar amounts of time participating in all but two types of activities. Children with autism spent more time readying their environment;

children with Down syndrome spent more time eating and drinking. Subcategory analysis revealed that children with autism were four times more likely to fail to respond. In summary, findings that children with autism behaved in a more sequential manner, engaged in one activity at a time, shifted frequently from one activity to another, and persisted in a given activity for a relatively short time suggest behavior of more immature children than expected based on mental age.

Doctoral Committee

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A Comparative Study of Natural Habitat Behaviors of Children with Autism and Children with Down Syndrome: An Ecological Approach

CHAPTER I

Introduction and Problem Statement

Autism is a developmental disability that is characterized by qualitative impairments in social and communicative behaviors and restricted interests (APA, 1994). The impairments in social relatedness in autism have been viewed by many researchers as the core problem (Fein, Pennington, Markowitz, Braverman, & Waterhouse, 1986; Rapin, 1991; Volkmar & Klin, 1993; Walters, Barrett, & Feinstein, 1990; Wing & Gould, 1979) and thought to be both qualitatively and quantitatively different from other childhood disorders (Kasari, Sigman, Yirmiya, & Mundy, 1993; Volkmar & Klin, 1993). Waterhouse and Fein (1991) explain that the social impairments are so complex that attempts to merely sum them up under a single label such as *social withdrawal* are inadequate. Kasari et al. (1993) describe the social problems in autism as a lack of social understanding rather than a mere lack of social interest. The nature of the social disabilities, however, has yet to be clearly delineated (Waterhouse & Fein, 1991). The most salient aspects of the disability—the social impairments—are the least studied (Schopler & Mesibov, 1986; Volkmar & Klin, 1993) and only now are beginning to receive significant attention (Schopler, 1994). Waterhouse and Fein (1991) explain that the "lack of a unified and adequate understanding of the biological basis of human sociability" (p.53) and the lack of acknowledgment of the heterogeneity of the social

deficit in autism reinforce the roadblock to a greater understanding of the social impairment.

Despite the limited descriptions based on empirical studies, researchers have proceeded with attempts to explain observed social impairments. One theory that recently has gained the attention of researcher investigates the role of cognition in social behavior. Baron-Cohen, Leslie, and Frith (1985) have provided evidence that most children and adults with autism lack a cognitive skill that would allow them to predict the behavior of other people by interpreting their emotions, beliefs, and thoughts. This skill has been associated with a construct known as *theory of mind* and thought to be one of the causes of the social impairment (Baron-Cohen, 1993).

Kasari et al. (1993) have confirmed deficits in beginning social behaviors that are thought to be the earliest observable precursors to later development of perspective taking or *theory of mind*. These researchers found that infants with autism have difficulty sharing attention with a caregiver concerning an object or event and propose that such three-way interactions are necessary for normal development of perspective taking.

Research examining perspective-taking ability is important because it is directly related to intervention. Choosing, implementing, and evaluating an intervention rests on the critical link between assessment and intervention. It is assumed that the way people understand others influences the way they behave (Shantz, 1983). Thus, the way children with autism perceive others is an important consideration. The converse is equally significant. The degree to which educators, parents, and psychologists appreciate the perspective of the child with autism and the interactive influences on social behavior, the

greater the likelihood of linking assessment with intervention. This bidirectional relationship suggests the need for research that incorporates the child in context with an interactive partner. Shantz (1983) characterizes such research as social-knowledge-in-action-in-context.

While studies on theory of mind in autism have suggested possible explanations for the observed social impairments, all have suffered from a major methodological limitation— a subject selection bias that excluded individuals who could not meet the communicative demands of the experimental tasks. Because it is estimated that 65 to 85% of individuals with autism have mental retardation (Gillberg & Coleman, 1992), social cognitive development of the majority of individuals with autism was not addressed.

Another weakness in social development research concerns the experimental context. Kasari et al. (1993) raised the issue of assessing behavior in limited situations such as laboratory settings, and highlight the need for examining responses of children with autism in various contexts that invoke complex social emotions from others. Volkmar and Klin (1993) caution the interpretation of research findings based on highly artificial experimental procedures because the "ecological context of relevant social behavior may be underappreciated" (p.50) and additional problems of equating social knowledge with actual use may occur.

Finally, although the social impairment in autism has been noted as a core deficit, this area has received the least systematic attention (Volkmar & Klin, 1993). A better understanding of the social impairments would aid diagnostic efforts and potentially

generate subtypes within the autistic spectrum that can guide intervention efforts (National Institutes of Health [NIH], 1995; Walters, et al. 1990; Wing & Gould, 1979).

The research proposed here addresses these issues (a) by sampling social behaviors in children with autism who have not been represented by previous social cognition studies because of their developmental skills and (b) by examining the social development of children with autism in the natural habitat. The ecological approach described by Scott and her colleagues (Scott, 1980; Carlson, Scott & Eklund, 1980) allows for in-depth study of an individual's stream of behavior and the assessment of social knowledge-in-action-in-context. Shantz (1983) explained that observing social interactions can reveal a child's explicit and tacit social knowledge and reasoning. The child as an *actor* in the social world, rather than a *knower* about the social world (e.g., theory of mind studies), provides data concerning social knowledge-in-action-in-context.

This study expands knowledge of the social behaviors and development of individuals with autism in relevant contexts and provides a foundation for future longitudinal research efforts in this area. Specifically, I (a) examined in detail the occurrence of natural habitat social behaviors of individuals with autism by employing a naturalistic observational design comprised of 8 participants between the ages of 6 and 10 years; and (b) compared the behaviors of these participants to those of children with Down syndrome of comparable adaptive communicative behavior levels during structured and unstructured activities at home.

CHAPTER II

A Framework for Understanding Autism and Relevant Methodological Issues

In order to provide an understanding of autism and a conceptual basis of the need for ecological psychology methods to study autism, this next section presents (a) definitions of autism and the issues surrounding diagnosis; (b) social behavior impairments in autism, (c) methodological weaknesses in the assessment of social behavior and cognition, and (d) ecological theory and research.

Introduction to Autism

Autism is a lifelong developmental disability that becomes evident in infancy or early childhood. Recognized as the most complex of the developmental disabilities (Allen & Rapin, 1990), autism is neither fully explained by a developmental model nor a medical paradigm; however, together they provide a more accurate picture of the disability (Bishop, 1989). Described as a spectrum disorder (Allen & Rapin, 1990; Rapin, 1991), the behavioral expression of autism ranges from severe to mild. This range of severity is observed across cognition, sensory, social, communication and motor domains. Autism can coexist with other conditions; the most common co-existing condition is mental retardation, as a number of research studies indicate that about 65 to 85% of children with autism also have mental retardation (Gillberg, 1990; Minshew & Rattan, 1992; Rapin, 1991). Other noted coexisting disabilities include fragile-X syndrome, neurofibromatosis, tuberous sclerosis, cerebral palsy, seizure disorder, blindness, deafness, and other syndromes such as Down, deLange, or Tourette's (Gillberg &

Coleman, 1993). About 50% of the children with autism are nonverbal or minimally verbal, and about 25 to 30% develop seizures by adulthood (Minshew & Rattan, 1992).

Although the incidence level for autism ranges from 5 to 20 of 10,000 births depending on the criteria used (Minshew & Rattan, 1992; Wing & Gould, 1979; Wing, Yeates, Brierley & Gould, 1976), a safe estimate is approximately 1 out of 1,000 (Gillberg, 1990; NIH, 1995). Autism is the third most prevalent developmental disability (Autism Society of America, 1995), and the autism spectrum disorders are not considered to be rare (NIH, 1995) as is often thought. There is no relationship between autism and socioeconomic status, race, ethnic or geographic origin (Gillberg & Colemen, 1992). Autism occurs about four times more often in males than in females (Rutter, 1985).

Medical researchers have implicated a neurological basis for the disorder; however, the exact nature or location of the brain abnormality remains unclear (Walters, et al.1990). As of yet, no single or multiple brain systems have been identified to explain the observed behavioral deficits (Rapin, 1991), although numerous functional and structural abnormalities have been found (NIH, 1995).

Problems with replication of findings, proper use of control groups, and varying methodologies have resulted in inconsistent results from structural studies. Some researchers have noted that the brains of persons with autism are large and heavy (Bauman, 1996; NIH, 1995). Bauman reported that in her post-mortem studies, the brains of children from birth to 12 years are 100 to 200 grams heavier than control brains. Observations of increased neuronal size and number/unit of volume is thought to be the cause of increased brain weight in the younger brains. In contrast the brains of

individuals over the age of 18 years are 100 to 300 grams lighter than control brains. Bauman and her colleagues (Bauman, 1996; Bauman, 1991; Bauman & Kemper, 1985) have further found reduced neuronal size in the forebrain, bilateral and symmetric loss of Purkinje and granule cell neurons in the neocerebellum, a lack of glial cell hyperplasia, and a surplus of retrograde olivary cells. She summarizes that, overall, a large portion of the brain is normal and that two systems—the limbic system and the cerebellum— are abnormal. The neurons in question appear immature, suggesting a curtailment in the developmental process. The limbic system and the cerebellum are related to emotion, learning, memory, attention, modulation of emotion in the higher cortex, affective behavior, conditioned reflex, mental imagery, anticipatory planning, language and regulation, consistency, and appropriateness of mental and cognitive processes. This immaturity suggests less reliable and slower processing of information.

Other structural studies by Courchesne and his colleagues have found abnormalities of hypoplasia of the cerebellar verbal lobules VI and VII, and reduced parietal lobe size (Courchesne, Press, & Yeung-Courchesne, 1993). Courchesne and his colleagues suggest that these abnormalities in brain systems are related to cognitive, sensory, autonomic, and motor processing (Courchesne, Yeung-Courchesne, Press, Hesselink, & Jernigan, 1988).

Disagreement about the onset of pathology is noted in the work of Bauman and Courchesne. Bauman's studies indicate an early onset pathology (Bauman, 1991; Bauman & Kemper, 1985), whereas Courchesne's findings implicate either a late-onset progressive atrophy or both (Courchesne et al. 1993). In a recent report of the NIH (1995) and one from Bauman (1996), the findings of an unusually large number of cells

that are too small in the limbic system and the widespread occurrence of affected Purkinje cells throughout the cerebellum point to the onset of pathology before 30 weeks of gestation. Because no common irregularity has been found across all individuals with autism who have been studied (Rapin, 1991), much work needs to be done in this area. Unlike the research based on structural studies, there appears to be more agreement among functional brain investigations. Deficits in late information processing, higher order cognitive abilities, and association cortex systems (NIH, 1995) have been found using various methodologies among different researchers. Evoked potential studies suggest intact early information processing. Neuropsychological research demonstrates problems in complex or higher order cognitive abilities (NIH, 1995; Minshew, 1994). The NIH report summarized these studies: "involvement is probably at the neural systems level of brain organization subserving adaptive behavior and function within society" (p.15). Structural and functional research findings appear to be consistent.

There is no known psychopharmacological treatment for autism; no neurotransmitter system has yet been implicated in all individuals with the disability. Elevated serotonin and dopamine levels, alteration of hypothalamic dopamine receptor sensitivity, hypothalamic dysregulation, and abnormalities of the endogenous opiate system have all been found in some individuals with autism (Campbell, Perry, Small, & Green, 1987). The NIH (1995) review of research, however, suggested that genetic analysis of neurochemicals is relevant to the study of autism because autism has a sibling recurrence rate of 4 to 10 times higher than that of genetically determined insulin dependent diabetes mellitus.

The Link Between Identified Abnormalities and Social Behavior

Abnormalities in brain systems have been linked to social/emotional development observed in autism. The NIH (1995) summarized that the amygdala (part of the limbic system) is important for recognition of affective stimuli, social stimulus-reward associations, perception of body movements and eye gaze, and orientation toward social stimuli. The frontal lobe and basal ganglia are associated with representation of action plans, motor planning and execution, and working memory. The cerebellum is associated with shifts in attention and modulation of sensory input. Focusing on multiple deficits in higher order cognitive processes, rather than on a primary brain structure, is suggested, as multiple structures at multiple levels have been associated with neural system problems (NIH, 1995). Gualtieri (1991) reported that, like mental retardation, there appear to be many etiologies and variants of autism. Bauman (1996) agrees that there are many variants of autism; however, she indicated that the variation is probably based on a common theme or etiology. This debate is important to theories of social impairment that are considered and discussed later.

Diagnosis of Autism

Because it is characterized by a combination of behaviors, autism is considered to be a syndrome (Rapin, 1991). The diagnosis is based on a triad of impairments including qualitative impairments in (a) communication, (b) social behavior, and (c) activities and interests (APA, 1994). As autism is based on what are considered to be core deficits, Sigman (1994) guidelines clarify what is meant by this. For a behavior to be a core deficit, it must meet three main criteria: (a) children must be willing to perform the

behavior, but lack the ability to do so, (b) the behavior must be specific (not shared by other children without autism) and universal (must appear in all children with autism), and (c) the behavior must be primary in that it emerges early in development. She concluded that in order for a deficit to be considered central to the disability, it must be evident in some way in all individuals with autism across the range of developmental levels. For the diagnosis of autism, the evidence of the triad of impairments during early development is critical.

Many classification systems have been used to characterize autism. The major system used by professionals in the medical field in the United States is the Diagnostic and Statistical Manual for Mental Disorders, 4th edition (DSM-IV), of the American Psychiatric Association (APA, 1994). States use the DSM-IV criteria, the Individuals with Disabilities Education Act (IDEA) criteria (Department of Education, 1992), or their own state guidelines to determine diagnostic eligibility. In Indiana, the criteria in Article 7, of Indiana Department of Education, are currently used to identify a child with autism (Indiana State Board of Education, 1992). The Article 7 requirements for autism are the same as the DSM-III-R criteria for autism (APA, 1987).

The most recent changes in the APA criteria of autism, from DSM-III-R to DSM-IV, for autism were based on empirical studies of classification. The issues behind the changes are related to this study and will be presented. Evaluating the worth of a diagnosis is similar to estimating the strengths of psychological tests (Szatmari, 1992; Werry, 1988). Criteria for a good classification are based on reliability, covariation, discriminability, and validity. Szatmari's (1992) review of the autism diagnosis in DSM-

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III-R concluded that sensitivity—the proportion of true cases identified—was high, whereas specificity, the proportion of true noncases identified, was low. The implication was that identified individuals presented a wider, more heterogeneous clinical picture. Thus, for clinical and research purposes, specificity was problematic and not useful in identifying differentiating autism from other developmental disabilities. This issue of the heterogeneity of autism is discussed in more detail later as a methodological weakness in social cognition studies and warrants the use of participants selected for the research reported here.

In order to remedy the problem of specificity, of being overly broad, and to create a better diagnostic scheme for autism, a field trial for identification of persons in the category of Autistic Disorder was conducted using the DSM-IV criteria. The results of this comprehensive undertaking were summarized in a report by 22 clinicians across North America, Europe, New Zealand, Asia, and the Middle East, with 125 raters and over 970 cases (Volkmar, 1995; Volkmar, et al., 1994). The study confirmed that the DSM-III-R definition of autism was overly broad and resulted in an increased chance of false positives, especially among individuals with severe mental retardation. The proposed DSM-IV criteria were found to have a better balance of sensitivity and specificity. Also, DSM-IV was conceptually the same as the ICD-10, the International Classification of Diseases, 10th edition, used more often in Europe. A brief comparative description of each of the diagnostic systems is provided in Table 1. The DSM-IV criteria for autism used for subject selection in this study are provided in Appendix A.

Table 1

Comparisons of the Core Deficits of Autism Across the Diagnostic Criteria

	Social	Communication	Other Behavior
DSM-IV	qualitative impairments in social interaction	qualitative impairments in communication	restricted, repetitive, and stereotyped patterns of behavior, interests, and activities
Article 7 and DSM-III-R	qualitative impairments in reciprocal social interaction	qualitative impairments in verbal and nonverbal communication and in imaginative activity	markedly restricted repertoire of activities and interests
IDEA	a developmental disability that significantly affects social interaction	a developmental disability that significantly affects verbal and nonverbal communication	engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences

Other Diagnostic Issues

Autism can be a difficult and confusing disability to identify due to the numerous classification schemes (Volkmar & Cohen, 1988). The wide variability of the clinical picture of autism across individuals, especially in the preschool years, often leads to misdiagnosis or lack of understanding (Allen, 1991). Autism is not merely a delay as noted in other disabilities like mental retardation, but a process of atypical development (Volkmar & Klin, 1993). Individuals who manifest the classic symptoms of autism are more likely to be diagnosed than those who exhibit less apparent symptoms (Allen, 1991). Diagnosticians who lack experience across a large number of cases may miss the elusive features of autism (Frith, 1989). Often the DSM-III-R heading of Pervasive Developmental Disorders - Not Otherwise Specified had been used as a means to *not* diagnose autism in those who manifest the triad of impairments: impairments in social interaction, impairments in communication, and rigid interests (Allen, 1988).

Much research has been devoted to the investigation of the psychometric properties of the autism diagnosis (see Rutter & Schopler, 1992). Despite all the diagnostic issues, Rutter and Schopler (1992) and Volkmar (1995) state that autism is thought to be one of the most valid childhood psychiatric diagnoses; it is uniquely different from schizophrenia, mental retardation, and specific developmental language disorders. Its identification is crucial for individuals and families (Bishop, 1989). Individuals with autism can achieve substantial advances in the development of skills over time (Rutter & Schopler, 1992), but the characteristics associated with autism remain throughout the lifespan, as longitudinal studies indicate (DeMyer et al. 1973; Kobayashi, Murata,

Yoshinaga, 1992; Lotter, 1974, 1978; Ruble & Dalrymple, 1996; Rutter, 1970; Rutter & Lockyer, 1967; Wolf & Goldberg, 1986).

Social Behavior Impairments in Autism

When autism was first described by Leo Kanner in 1943, he explained that the ability of individuals to relate to others was so fundamentally impaired that they showed an "extreme aloneness from the very beginning of life" (1943, p.248). His keen observations have withstood the test of time (Volkmar & Klin, 1993) as the impairments in social relatedness are still maintained by many researchers as the core problem (Fein et al. 1986; Rapin, 1991; Volkmar & Klin, 1993; Walters et al. 1990; Waterhouse; 1994; Wing & Gould, 1979), are used primarily for syndrome definition (Volkmar & Klin, 1993), and are considered to be both qualitatively and quantitatively different from impairments in social development observed in other childhood disorders (Volkmar & Klin, 1993).

Contrary to Kanner's earlier beliefs about autism, researchers now understand that even though people with autism do experience problems with relating to the emotional life of others, they do indeed experience social interest and emotional attachment (Kasari et al. 1993; Minshew & Rattan, 1992; Sigman & Mundy, 1989). The real difficulty for persons with autism lies in their reduced ability to learn normal social behaviors in a typical manner. Difficulties in learning social interactions in an unstructured fashion (Ferrara & Hill, 1980; Lord, 1984), in initiating social behavior without supports (Lord, 1984), and in sustaining social interactions in a reciprocal fashion (Lord, 1984; Smith, 1990; Walters et al. 1990) are major obstacles for these individuals. Inability to differentiate and classify emotions (Hobson, 1986), communicate accurately and

competently with others (Wetherby, 1986), take the perspectives of other individuals (Baron-Cohen, Leslie, & Frith, 1985), and consider their own and others' viewpoints (Baron-Cohen et al.1985; Howlin, 1986) are also common problems experienced by children with autism.

The reason for the lack of reciprocity in the social behaviors of children with autism remains unclear. Researchers have debated the primary deficits in autism (Waterhouse & Fein, 1991) and whether this difficulty in sustaining reciprocal interactions is due to a *social or cognitive deficit* because of the complex cognitive processing required. Social responsiveness requires the child to attend to a multitude of social cues and to interpret and respond to these cues in a manner that is appropriate for the social context (Howlin, 1986). The structural and functional brain research studies previously summarized suggest that the social problems are a likely consequence of abnormalities found in identified brain areas. Extensive reviews of the research on social behavior impairments in autism are provided by Dawson and Galpert (1986), Howlin (1986); Lord (1993); Schopler and Mesibov (1986); Sigman (1994); Sigman and Capps (1997), and Walters et al. (1990).

The social impairment is evident in the first three years of life and is usually presented in one of three fashions (Minshew & Rattan, 1992). In the first form, parents observe problems at infancy (Allen & Rapin, 1990). They report that their child cries or stiffens when held, fails to initiate or anticipate contact, and is happy to be left alone for long periods of time. The second type of social impairment is not detected until the child is 18 months to 2 years of age. These children display a lack of interest in peers and a

preference for being alone. Lack of eye contact with others and delayed language development are also noted (Minshew & Rattan, 1992). In the final type of observation, a developmental setback is noted between 12 and 24 months of age in the areas of language, socialization, and play, following a period of normal or near normal development (Allen & Rapin, 1990; Minshew & Rattan, 1992). The course of social development that follows does not seem to be related to the three types of early social impairments displayed (Minshew & Rattan, 1992).

In the next section a description of the main research areas of the social impairments concerning attachment, social interest, eye contact, social communication, social cognition, symbolic play, and recognition and communication of emotions will be presented. Next, the various methods used to assess social behavior will be discussed.

Attachment, Social Interest, and Eye Contact

Most of the social behavior studies have examined responses of young children with autism as they interact with adults. Reflecting the developmental change of behavior over time, studies conducted on older individuals are more concerned with interactions with peers (Howlin, 1986; Lord, 1984). Because it was believed that autism was defined by a lack of social interest, clinical lore once suggested that children with autism lacked attachment to their caregivers (Walters et al.1990) and were aloof and unresponsive to parents (Sigman & Mundy, 1989). The extensive work by Sigman and her colleagues (Sigman & Ungerer, 1984; Sigman & Mundy, 1989) demonstrated that children with autism did, in fact, show reactions similar to control group children when separated from and reunited with their mothers. In Sigman and 's review of her research program, she

reported no differences between groups of children with autism, children with mental retardation, and normal children in the number of times they looked at their caregiver during a structured play situation. Children with autism increased their eye contact with their parents when parents attempted to elicit social interaction, and they initiated and responded to social offers as much as control group children. Sigman (1994) summarized that children with autism do form social attachment to their caregivers.

Based on earlier studies of gaze aversion, or the failure to gaze fixate, it was assumed that looking directly at an individual signified a readiness for interaction (Hutt & Ounsted, 1966). Various theories were put forth concerning the lack of eye contact observed in children with autism. However, in Howlin's (1986) review of this research, she noted that some researchers found differences in the eye contact of children with autism and control group children, while others did not. Discrepant findings and assorted theories of gaze aversion led Howlin (1986) to question the construct. She cited inconsistent measures and the lack of what constituted *normal eye gaze* as problematic. Howlin (1986) explained that it is the "deviance in the reciprocal quality of eye contact that distinguishes autistic from normal children and not simply gaze avoidance" (p.114).

Social Communication

In addition to being inaccurately portrayed as noninteractive and unresponsive (Sigman, 1994), children with autism were also described as noncommunicative (Wetherby, 1986). The research on communication has often been neglected in studies of social behavior, and difficulties in cognition and communication must be taken into account in studies of social behavior (Schopler & Mesibov, 1985). Recent research on

communication has shifted toward the functional or pragmatic use of language within a social context (Stone & Caro-Matrinez, 1990). Indeed, researchers have found that infants with autism lack a very early skill in joint attention that is proposed to lead to later development of communicative competence (Walters et al. 1990) and a more complex skill of perspective-taking (Mundy & Sigman, 1989; Baron-Cohen, 1991c).

The earliest deviation from normal prelinguistic and social development in children with autism is noted by a lack of bids for joint attention (Sigman, 1994). A study by Curcio (1978) found that nonverbal children with autism used gestures to communicate such acts as greeting, requesting, and refusing. However, pointing or showing gestures were not displayed. Wetherby (1986) analyzed videotaped interactions of children with autism and normal children during a free-play and structured condition. She found that the children with autism displayed both qualitatively and quantitatively different communicative functions from the control group children. The children with autism displayed more interactive acts that led to an environmental consequence (satisfying a physical want or need, which included requesting object, requesting action, and protesting), and fewer interactive acts that led to a social consequence (a verbal or nonverbal response that involved an adult and included requesting social routine, requesting permission, requesting information, acknowledging other, showing off, and commenting) than did the control group children. Wetherby (1986) reported that children with autism lacked the ability to attract the attention of an adult to the child or an object, as an end in itself. This is believed to be a critical skill for the development of and use of language to achieve a social end.

Wetherby's findings can also be explained, however, using the research that suggests that, as normal children develop, their ability to communicate verbally grows. As a result, they use fewer physical and more verbal strategies to solve problems (Rubin & Rose-Krasnor, 1992). Stone and Caro-Martinez (1990) found that communication skills of children with autism were related to the child's cognitive level and severity of autism. Children who were nonverbal were described as "striking" because of the notable lack of joint attention. The prototypical communicative method entailed a child directing a motoric form of communication toward the teacher to request something or to attract attention to the child. This research substantiates the use of physical strategies by children with autism, rather than verbal forms, to communicate with others and solve problems.

Wetherby's findings also point to the difficulty of interpreting communicative acts that may serve multiple purposes of problem solving and social interaction. Wetherby (1986) summarized that the communication profile of children with autism was atypical and delayed from that noted in normal development. Her experiment underscores the difficulty in trying to separate social behavior from communication ability.

Another set of empirical studies help explain Wetherby's research. Sigman (1994) noted that by the end of the first year of life, normal children begin looking at others and this in turn creates a *shared experience*. This social referencing of infants is observed more in ambiguous situations when the child is searching for information from the adult. By the age of two years, infants frequently display protodeclarative gestures, that is, pointing to objects and showing objects to familiar adults; however, most children with

autism do not display social referencing and protodeclarative gestures (Baron-Cohen, 1989; Mundy & Sigman, 1989; Sigman, 1994). Studies of affective and communicative development of young children with autism find that infants display deficits in sharing affect and attention with a caregiver (Kasari et al. 1993; Sigman, Kasari, Kwon, & Yirmiya, 1992). These deficits are thought to be the earliest indicators of an impairment in the intersubjectivity that is thought to be an important precursor of perspective-taking. Sigman (1994) theorizes that the lack of social referencing and protodeclarative gestures result from children with autism failing to understand "other people as having views, ideas, or emotions that can be shared" (p. 146). This theory is compatible with the idea that children with autism lack a *theory of mind*, an ability to understand others based on their emotions, beliefs, and thoughts.

Social Cognition

A study on the perspective-taking performance of children with autism links the ability to consider others' viewpoints to social skills. Dawson and Fernald (1987) assessed perspective-taking ability of children with autism from performance on three tasks that tapped into perceptual, conceptual, and affective perspective-taking. They correlated the scores from these tasks with measures of social behavior, nonverbal IQ, and receptive language. Their findings indicated that the perspective-taking scores related more to social behavior than did measures of IQ and language.

Another group of investigators from England (Baron-Cohen et al. 1985) studied the development of perspective-taking. They found that most individuals with autism have some degree of a specific deficit in perspective-taking. An inability to develop a theory

of other people's minds led the researchers to call their construct Theory of mind, a cognitive skill that would allow people to predict the behavior of others by interpreting their emotions and thoughts. Baron-Cohen et al. conducted a seminal study in 1985 investigating their theory. Using a puppet play paradigm that was adapted from Wimmer and Perner (1983), the investigators had children with autism, children with Down syndrome and normally developing children respond to questions that required them to take the perspective of another. The children observed a scenario involving two dolls, Sally and Anne. Sally had a basket in front of her, and the experimenter placed a marble in the basket. Then Sally left, and the marble was moved to Anne's box. When Sally returned, the experimenter asked the critical belief question: "Where will Sally look for her marble?" The children passed if they considered Sally's false belief and pointed to the marble's original placement. If they pointed to its current spot, they failed to take into account Sally's belief. The authors used two control questions: "Where is the marble really?" (a reality question) and "Where was the marble in the beginning?" (a memory question). All children passed the reality and memory questions. Of the children with Down syndrome and the typical children, 85% and 86% respectively, passed the belief question. In contrast, 20% of the children with autism passed the belief question. These results are even more striking when the characteristics of the children are considered. The mean age of the control children was 5 years, and the mean age of the children with autism was 12 years. The mean intelligence level of the children with Down syndrome was 64, and the mean intelligence level of the children with autism was 82.

Since this original study, several other researchers have replicated the finding that a majority of children with autism perform significantly worse than other groups on perspective-taking tasks (Charman & Baron-Cohen, 1992; Holroyd & Baron-Cohen, 1993; Ozonoff, Rogers, & Pennington, 1991; Reed, 1994; Reed & Peterson, 1990). The poor performance of individuals with autism on theory of mind tasks has led researchers to propose the existence of a specific cognitive deficit that is particular to autism and explains the observed social impairments (Baron-Cohen, 1991b; Frith, 1989; Holroyd & Baron-Cohen, 1993; Leslie, 1991; Leslie, 1992).

Theory of mind has also been referred to by researchers of normal development in more general terms as the ability of individuals to understand emotional states and make appropriate references to them (Bretherton, Fritz, Zahn-Waxler, & Ridgway, 1986). The theory has been extended to include the ability to make distinctions between what someone believes (their mental world) and a real situation, or the capability of understanding false beliefs (Leslie, 1991). By age six, children understand that the emotion a person displays may not correspond with what that person is feeling (Shantz, 1983).

Harris (1990) explained that the attainment of a theory of mind is universal. Research performed in the United States, the United Kingdom, and Austria shows that there is a marked shift between the ages of three and five. Children who are three and four years old usually make mistakes with false beliefs, but children four to five years old correctly anticipate the beliefs of others. The idea of false belief is provided by this example. Six year olds were asked how a girl would feel given a box of Smarties, a candy she did not

like, before opening the box and then find that Polos, her favorite candy, was inside. Most of the six year olds responded correctly that she would be sad at getting Smarties then happy at finding Polos. In the first case, the children had to take into account the girl's false belief that the candy was Smarties. In the second case, the children had to account for the revised belief and the girl's desire for the Polos. This experiment illustrates how children can understand beliefs and desires and be able to predict emotion. Several researchers have shown that a small number of high cognitive functioning individuals with autism are also able to pass false belief tasks (Baron-Cohen, 1991a; Baron-Cohen et al. 1985; Eisenmajer & Prior,1991; Ozonoff, Pennington, & Rogers,1991; Reed,1994; Reed & Peterson,1990). The methodological limitations and confounding variables of this area of research are discussed later and are important to the merit of the present research.

Symbolic Play

Another difficulty for children with autism that is thought to be related to deficits in perspective taking and sharing of affect with others is deficits in symbolic play (Wing & Attwood, 1987; Rutter & Schopler, 1987; Walters et al. 1990). Children with autism are more likely to manipulate objects rather than play with them in a symbolic way. Baron-Cohen (1987) and Mundy & Sigman (1989) suggest that children with autism have difficulties in representational capacities or the ability to form "meta-representation." Baron-Cohen (1987) believes that children with autism can form first-order representations, or the ability to represent the world as it is. However, they lack second-order representations, or the ability to simultaneously know of an object while pretending

it is something else (e.g., holding a banana to the ear while pretending it to be a phone).

Recognition and Communication of Emotions

Miller and Aloise (1989) suggest that normally developing children in the first and second year of life have social cognition, or an understanding of emotions in others (Bretherton et al. 1986). Bretherton, McNew, and Beeghly-Smith (1981) state that the onset of language with emotion occurs around 18 to 20 months of age. Furthermore, infants between 18 and 36 months can (a) label their own and others' emotions, (b) discuss past and future emotions, and (c) talk appropriately about the causes and consequences of emotional feelings. In a study by Bretherton and Beeghly (1982), mothers of 28 month olds kept reports of child verbalizations. The statements were grouped by six categories representing internal-state words. Analysis of these utterances revealed that these children were able to interpret their own feelings and the mental states of others. Furthermore, the children were able to discuss how their own feelings or another's could be changed or what caused the change. Bretherton and Beeghly (1982) provided evidence that young children are able to engage in perspective-taking and have a theory of mind at an early age when alternative methods of gathering data were employed (e.g., parent report, naturalistic observation). It has also been shown that when tasks were modified to be simpler and clearer, children with autism were more likely to pass perspective taking tasks. This issue is discussed later as a methodological weakness in social cognition research. There are few studies on children with autism below three and one-half to four years of age (Lord, 1993), and no studies describing the onset of

language with emotion of children with autism using the methods described by Bretherton and Beeghly (1982).

Hobson has conducted a series of laboratory studies investigating the ability of children with autism to understand emotion. In one study, Hobson (1986) showed children with autism videotaped sequences of contexts for emotion. They were instructed to select a drawing to *go with* the scene. The children were shown five pictures after the videotape presentation and then asked to choose the picture that tells *what happened next*. The children were able to successfully select the next sequence of action. In a subsequent experiment he had children select from a series of five schematic drawings the picture that went with the person in the videotape. The drawings captured emotional gestures such as happy, unhappy, angry, and afraid. The results showed that the children with autism were able to match drawings to a person enacting the gestures on videotape. However, they were impaired in matching the schematic gestures to recorded vocalizations or videotaped faces. Hobson (1986) concluded that the children with autism have difficulty with coordinating emotion recognition by integrating expressive faces, gestures, and vocalizations.

In another study, Weeks and Hobson (1987) had children with autism sort pictures. They told the children to take notice of one way in which two pictures were different and sort the pictures based on this difference. All the pictures were of people smiling or not smiling and wearing either a woolen or floppy hat. The children with autism were more likely to sort pictures based on the hat instead of the facial expression. The mental age matched control group children were more likely to use expression to sort the pictures.

The author concluded that the children with autism were deficient in the capacity to be aware of emotional signals, a *pre-wired* capacity in normally developing children (Walters et al. 1990). The findings of this study were not replicated when children with autism were matched by verbal age to the control group children (Prior, Dahlstrom, & Squires, 1990). Hobson matched children by nonverbal IQ only.

Studying empathy in a group of high functioning children with autism (children without mental retardation), Yirmiya, Sigman, Kasari and Mundy (1992) showed videotaped segments of stories comprised of children experiencing different events and emotions. Children were asked to label the emotion and then describe how it made them feel, as a measure of empathy. The children with autism scored significantly lower than the control group children. The authors concluded that autism is an impairment of cognitive and social/affective deficits. In summary, Howlin (1986) warns that analogue research used in these studies is problematic in generalizing findings across the autistic spectrum and that normative data are essential.

Studies of Older Children with Autism

Studies of older children with autism focus on interactions with peers (Howlin, 1986; Lord, 1984). While improvements in relationships with adults occur as children with autism age, marked abnormalities remain with interactions with peers. An absence of cooperative play and a lack of reciprocity in interactions are the most salient features. Most studies of social behavior have been based on quantitative measures, such as time spent in play or the number of gestural, motor, or verbal behaviors displayed (Howlin, 1986), and most of the measures have been part of a study that has looked at the effects

of intervention. Few studies have been conducted in the natural environment, and even fewer have compared the behavior of children with autism to appropriate matched groups of children.

Some of the few examples of research on the qualitative nature of social behavior are provided. McHale (1983) examined the more qualitative aspects of social behavior in the natural environment. She conducted observations of weekly play sessions of children with autism and normally developing children in their public elementary school. She recorded target behaviors in continuous, 15-second intervals for a total of five minutes for each of the children. She recorded the frequency of play and communication, and the quality of the social behavior as solitary or interactive. Behavior was also assessed from photographs taken every minute. The pictures were analyzed for the type of toys or activities involved, the number of children in a group who were engaged in an activity, and the type of activity. The amount of time the children with autism engaged in particular activities increased significantly from week 1 to week 10, and the amount of solitary behavior decreased significantly. No differences were found in time spent in play or in communication, and frequency of play with different toys.

A series of studies conducted by Lord and her colleagues (1984) examined the interactions of children with autism and their peers. She used a combination of quantitative, qualitative, and interactive units to measure social behavior. She noted that normal children interact with adults and peers for different reasons. Adult traits such as nurturance or dominance are found in child interactions with adults (Barker & Wright, 1955/1971). Interactions with children often involve reciprocal and repetitious

imaginative use of objects and play. Thus, it becomes clear that when the problems of symbolic play and perspective taking of children with autism are considered, they are at a great disadvantage during peer interactions.

Table 2 shows the quantitative, qualitative, and interactive measures used by Lord and her colleagues (Lord, 1984) to assess social behavior. In this study, six children with autism participated in a training program of 15-minute sessions for 10 days. Baseline data had been collected by videotaping the children in groups of three playing in the treatment room for 15 minutes the day before. Time samples of 15 seconds were scored by two observers using the measures described in Table 2. At baseline, very little interaction was observed. Five of the six children with autism were observed to engage in fewer than four of the possible 60 reciprocal interactions (based on 15-second intervals) with a normal peer. They responded to less than 25% of the peer initiations for play. In a typical interaction, the peer initiated play with the child with autism, and in one out of four cases, the child with autism responded. Although Lord's goal was to collect pre- and post-data regarding her treatment program, she did not intend to collect illustrative descriptive data of social behaviors. The peers were strangers to the children with autism, the room was novel to them, and no comparable data with normal children were used (Howlin, 1986).

Van Engeland, Bodnar, and Bolhuis (1985) used ethological methods to compare the social behavior of children with autism to control group children in a clinical setting. They collected observations of behaviors at what they considered the molar level. They defined molar behaviors as "larger fragments of the stream of behavior" (p.880) and

Table 2

Types of Measures and Behaviors of Interactions (from Lord, 1984)

Quantitative Measures	Time spent in interaction
	Ratio of autistic child's responses to number of initiations received
	Number of initiations made by child
	Length of sustained interaction
Qualitative Measures	Maintenance and toleration of proximity to others
	Time attending to others
	Time spent in self-stimulatory activities
	Time in solitary play
Interactive Measures	Types of responses made by autistic child (verbal vs motor-gestural vs object oriented)
	Types of initiations made by autistic child (imitative vs nonimitative)
	Types of initiations receiving a response from autistic child (appropriate vs inappropriate, beginning vs continuing)

included examples of such behavior as social play, solitary play, physical avoidance, and initiation of social interaction. They contrasted this method with a molecular approach which measures behavior that cannot be traceable to other behavior, such as gaze avoidance or visual fixation. They explained that the molecular approach avoids problems of concept definition but misses the qualitative aspects of social behavior, and that the advantage of the molar approach was that behavior of clinical significance could be studied at a qualitative level. However, a problem with the molar approach "is that a strong intuitive-interpretive factor plays a role in defining the units of analysis" (p.880). They explain that there is a risk of determining the units of behavior a priori as coherent, and that existing temporal relations between behavior may be overlooked.

Van Engeland et al. (1985) examined both the qualitative aspects of behavior, the way in which behavior is embedded in the stream of behavior, and the structural organization of behavior. They had 20 children with autism with a mean age of 8.8 years individually enter a playroom with a familiar person. The children were instructed to play with materials for about 20 minutes. Then the experimenter entered the room and made active attempts to establish social contact with the child using a four-stage procedure. The social interactions were recorded on videotape and lasted five to nine minutes. Samples of five second intervals were coded and analyzed. The coding protocol was based on 51 behavior elements developed from a pilot study. Main categories included facial expressions, body postures, verbalizations, head postures, gestures, and interpersonal distances. The frequencies of each behavior were determined and compared to the number of behaviors observed in the control group of age- and gender-matched children.

They also determined the frequencies of transitions between behaviors. A correlation matrix based on the observed and expected frequencies of transitions was developed, and a principal components analysis was performed on the correlation matrix in order to determine the degree of coherence among behaviors.

Their findings indicated that of the 51 behavior elements, three were not observed in either group (angry frown, frown, yawn), one was observed in the control group only (shrug), and six were observed in the children autism (touch, flap, take, echolalia, face away, and hold out hand). Of the other 41 behaviors that were observed in both groups, the mean frequencies were significantly different in 15 of the behaviors (react, sit down, stand, answer, echolalia, vocalization, face, look partner, look table, nod, shake, take, automanipulation, touch, far away). They then analyzed 33 behaviors that were reported at a minimum frequency with transitions to other behaviors. The principal components analysis revealed six behavior systems in both the control group children and the children with autism. They named the following factors for the control group children as follows: F1 = nonverbal communication; F2 = body movements; F3 = object communication; F4 = interpersonal distance; F5 = inferential communication; and F6 = verbal communication. The factors for the children with autism were labeled Fa = nonverbal communication; Fb = stereotyped behavior; Fc = verbal communication; Fd = body movements; Fe = object communication; and Ff = bipolar interpersonal distance.

The findings indicated that the children with autism displayed *echolalia* more, *answer* less, *touch* more, *take* more, *nod* less, and *shake* less. The reciprocal behaviors of answer, nod, and shake were clearly lacking in their behaviors. Their study failed to find

differences in eye contact of the children with autism and the control group children. The factor analyses revealed that the organization of behavior was better structured in the control group children as 60.8% of the variance was explained for them while 50.6% of the variance was explained in the children with autism. The behavior of the children with autism did not include *inferential communication* found in the control group, but did include *stereotyped behavior* missing in the control group.

A separate factor analysis of the experimenter's behavior while interacting with the children revealed that the experimenter behaved differently with each group despite instructions to the contrary. The experimenter made more use of *object communication* and was more often *close* to the children with autism. He more often *touched*, less often *laughed*, and less often *smiled*, as well. Van Engeland et al. (1985) explain that transactional phenomenon led the experimenter to behave differently due to the characteristics of the children.

The theoretical orientation of this study, i.e., examining molar behaviors as they comprise larger fragments of the stream of behavior, is particularly analogous to the theoretical conceptions described in Barker and Wright's Midwest and Its Children (1955/1971) and Wright's Recording and Analyzing Child Behavior (1967). These works comprise the basis of the ecological method proposed in this study and described in detail later, and their viewpoint of ecological research using molar behavior and the stream of behavior was used. In contrast to the Van Engeland et al. (1985) study, the research reported here used units of social behavior as they naturally occur within the environmental context from the perspective of the child.

A recent naturalistic study investigated the social initiations of children with autism to verbal-matched children with retardation during structured (lunchtime) and free activities (play) at school. Hauck, Fein, Waterhouse, and Feinstein (1995) assessed behavior by conducting four 15-minute observations on different days. The observer recorded the behavior by a Behavior Coding Scheme (BCS). The BCS was developed to be used for real-time coding of behavior, for collecting narrative notes of behavior, and for coding from videotapes. Because the videotape recording of behaviors was not feasible in that setting, the observer noted events in which the child initiated a social interaction and then described the type of initiations in running notes. Passage of time was recorded by making a slash mark on the recording sheet when a tone was produced from a tape recording every 15 seconds. This study is comparable to the present research by the use of running narrative notes to account for the temporal structure of the child's behavior. The findings from the study indicated that the children with autism were observed to initiate fewer interactions with peers and the same number of interactions with adults as the comparison children. The children with autism were observed to exhibit more ritualized initiations. The children's initiations to peers were unrelated to severity of autism, but related to cognitive skills. The comparison children's initiations were unrelated to cognitive level. The authors conclude that the children with autism differed in the quantity of their initiations to peers and the quality of their initiations to adults. They suggest that initiations to peers may be a useful index for social development.

Social Skills Intervention Studies

An important outcome of social behavior studies is knowledge to link the impairments of children with autism to empirically supported interventions. Interestingly, while there is a dearth of studies regarding the nature of the social impairments in autism, a great deal of work has been done on social skills interventions for children with autism. Researchers have explored the efficacy of three primary methods of intervention: (a) peer-mediated (Goldstein, Kaczmarek, Pennington, & Shafer, 1992; Haring & Breen, 1992; Kamps et al. 1992; Kohler, Strain, & Shearer, 1992; Oke & Schreibman, 1990; Sainato, Goldstein, & Strain, 1992), (b) student-mediated (Kamps et al., 1992; Koegel, Koegel, Hurley, & Frea, 1992; Oke & Schreibman, 1990; Stahmer & Schreibman, 1992), and (c) teacher-assisted social skills interventions (Kamps et al., 1992).

First, peer-mediated intervention involved training socially competent peers to initiate interactions with the student with autism (McEvoy & Odom, 1987). Oke and Schreibman (1990) suggested that this method is preferable to teacher-assisted, because (a) adult prompting does not disrupt the ongoing social interaction, (b) it does not require the presence of an adult, and (c) it does not rely on prompts. However, some problems do occur with peer-mediated intervention. This strategy does not increase the initiations from the child with autism, and it does not generalize well across settings.

A second intervention method, student-mediated intervention, is defined by focusing on the individual with autism to initiate social interaction. The student is taught initially by an adult. This has been shown to increase both the rate of positive initiations and the amount of positive social interaction (Oke & Schreibman, 1990). It has only been in the

last few years that research has addressed self-management, or student-mediated intervention; however, initial results seem promising.

The third intervention, teacher-assisted mediation, has also been shown to increase the rate of initiations of the child with autism (McEvoy & Odom, 1987). The most typical forms of teacher intervention are prompting and providing positive reinforcement. The research in this area has been criticized, however, because (a) studies have occurred in highly structured training settings using well-trained professionals, and (b) this type of intervention disrupts ongoing interactions (McEvoy & Odom, 1987). Despite the limitations of this intervention, research suggests that children with autism do not initiate unless prompted by a teacher. Teachers have successfully conducted group activities to promote social interactions. They have used games, songs, and other materials to increase the interactions of children with autism (Brown, Ragland, & Fox, 1988; Kohler, Strain, Maretsky, & DeCesare, 1990; McEvoy & Odom, 1987).

Regardless of which intervention is selected, a major issue to consider when training social interaction is the generalization of the intervention across settings, people, and time. Researchers suggest that multiple peer-exemplars enhance generalization across settings and people, and peers' self-monitoring and the student's self- monitoring prolongs generalization across time (Haring & Breen, 1992; Koegel et al. 1992, Sainato et al. 1992; Stahmer & Schreibman, 1992). Therefore, a combination of all three strategies—peer-mediated, student-mediated, and teacher-mediated—is suggested for intervention. Given the complex nature of the social impairments in autism, it is no surprise that intensive, structured and well-planned environments with knowledgeable

people are required for effective intervention (Hauck et al. 1995), and that the environmental context needs to be evaluated in studies of social impairment.

Theories of the Biological Basis of the Social Behavior Impairments

Various theories have been suggested for explaining the social impairments in autism (Waterhouse & Fein, 1991), which were alluded to earlier in the medical review of autism. Not much time has passed since the 1960's when it was first thought, under the framework of psychoanalysis, that autism was caused by *refrigerator mothers*. Parents were blamed for creating a rejecting and harmful environment that caused their child to retreat from the world (Bettelheim, 1967), and treatment was comprised of institutionalization (Bettelheim, 1967) or, as described by Schopler (1994), parentectomy. It soon became clear that this view was not empirically supported (Cantwell & Baker, 1984; Schopler, 1994), and that autism was a neurological disorder (Fein et al.1986; Minshew & Rattan, 1992; Schopler, 1994; Schopler & Mesibov, 1987).

While great strides have been made in understanding autism, a key aspect of the disability, the social impairment, is still vague and controversial (Schopler, 1994; Waterhouse & Fein, 1991). Waterhouse and Fein (1991) explain that researchers debate the biological nature of the social impairment and generally align themselves within one of three primary theoretical positions: (a) a single old-brain system deficit in arousal, reward, motivation, or affect (Hobson's studies), (b) a single new-brain system deficit in cognitive skills (Baron-Cohen's studies), or (c) a complex array of deficits in a variety of brain systems (NIH 1995 recommendations), or a single deficit in a complex array paradigm (Waterhouse & Fein, 1991).

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In the first viewpoint an older and more basic deficit in mental processing is thought to have impact on sensory analysis, social motivation, social learning, and later social behavior (Waterhouse & Fein, 1991). It is thought that early problems with attention impede later learning of skills such as language. Irregular, unbalanced, or overfocused attention may lead to problems with social learning. This viewpoint is similar to the more recent information-processing models (Pettit, 1992; Rubin & Rose-Krasnor, 1992) put forth to explain normal social development and is described later.

In the second orientation a single new-brain deficit is thought to have an impact on the most novel and intricate of cognitive skills. Researchers cite problems with understanding the perspective of other people as the explanation of the observed social impairments in autism (Baron-Cohen et al. 1985; Charman & Baron-Cohen, 1992; Holroyd & Baron-Cohen, 1993; Ozonoff et al. 1991; Reed, 1994; Reed & Peterson, 1990). This ability is thought to be the most complex of cognitive skills (Waterhouse & Fein, 1991).

The third orientation states that social behavior is dependent on "a large constellation of brain systems working well, and that a deficit in any subsystem will impair the expression of normal social behavior" (Waterhouse & Fein, 1991 p.55). The complex relationship between both affective and cognitive components of social behavior have caused some researchers to believe that all "other human skills are *smaller* in scope" than is social behavior (Waterhouse & Fein, 1991, p. 55). "The measurable language and perception skills that we label as *cognitive*, and that may be spared in some autistic individuals, do not require as complex a temporal interplay of sensory analysis,

integration of drive states, recall of episodic memory and complex sequential motor patterning all within the same response as does social behavior" (Waterhouse & Fein, 1991, p.56). Thus, the more elements that are required to operate a system, the more likely the possibility of errors occurring in some component of the system. Any error earlier in the system can open a window for extreme variation. Many neurological deficits in perception, affect, cognition, or attention could create impairments in sociability and social cognition observed in autism (Waterhouse & Fein, 1991).

Theories of Social Development

To what extent do theories of normal social development lend themselves to understanding social impairments in autism and contribute to relevant biological theories of social development? Damon (1977) stated that researchers recognize that children have a complex and dynamic understanding of their social world. However, psychological studies have not been able to capture this complexity (Damon, 1977), and only recently have researchers made relevant attempts (e.g, studies on infants' knowledge of emotion in others). The construct of social learning was the earlier guiding framework for understanding social behavior; then developmental models that considered children as active participants in the construction of their social knowledge were introduced (Damon, 1977). Damon criticized the work on social cognition, because it assumes that social knowledge is nothing more than obtaining an understanding of other persons. It ignores the dynamic and subjective nature of relationships. More recently, researchers acknowledge the importance of interactions with others and state that the "network of relationships constitutes the most important part of the child's environment"

(Hinde, Perret-Clermont, and Stevenson-Hinde, 1985, p. xiv). Other theories of social development come from psychoanalytic, cognitive-developmental, and ethological-attachment theory (Pettit, 1992). A brief description of these will be provided as detailed reviews are provided elsewhere (Van Hasselt & Hersen, 1992).

While psychoanalysis is not comprised of a unified theory of social development, its focus has largely concerned the impact of intrapsychic development during the first five years of life on later development (Lerner & Ehrlich, 1992). Psychoanalytic models include (a) psychology of the self, (b) object relations theory, (c) modern structural theory, and (d) developmental theory. Developmental theory is based on systematic, naturalistic, and longitudinal study of infants and children. Mahler and her colleagues have termed development as being comprised of the *separation-individuation process* (Lerner & Ehrlich, 1992). Infant differentiation from a symbiotic fusion with the mother leads to later, more autonomous functioning. Lerner and Ehrlich (1992) state that "this approach offers a flexible balance between ideographic and nomothetic methodologies" (p.55). Problems with operationalizing terms, a lack of objectivity and replicability, and a lack of rules to predict later behavior limit the utility of psychoanalysis (Pettit, 1992). Psychoanalytic theory provides an example of a highly inferential level of social behavior analysis used to study development.

As a polar opposite to the level of analysis used in psychoanalysis, social learning theory has provided information at the molecular level. This theory examines the acquisition of discrete behaviors, or the explanation of individual differences. It has been applied to temperament, infant attachment, and aggressive behavior (Brooke, Messer, &

Gross, 1992) and focuses on one's social environments and the corresponding stimuli presented by other variables. Social behaviors are defined as the "responses under the actual or potential control of social stimuli" (Brooke et al., p.82). Social learning theory concepts include principles of learning (e.g., discrimination, shaping, unconditioned stimulus, etc.) and cognitive-mediational constructs that are tied to overt behavior. Social learning theory has been criticized for its exclusive emphasis on environmental contingencies. Current theories, however, include the role of organismic variables in learning and are concerned with how organisms acquire and maintain responses. The *organism action-environmental reaction* chains are thought to shape and mold social development. The level of analysis is largely conducted at the micro-social (molecular or face-to-face) level, using direct observations of interactions between the individual and the environment (Brooke et al. 1992).

A third theory, cognitive-developmental, is largely influenced by Piaget. Unlike the psychoanalytic and social learning theories, Piaget conceived the child as actively engaged with the environment (Pettit, 1992). He viewed the child as motivated by curiosity and the need to master the environment, rather than by inner biological drives or external reinforcement. Piaget's work has contributed to the investigation of how cognitive development influences social development (Pettit, 1992). This social-cognitive approach deals with how individuals come to understand the perspectives of others and how this knowledge influences behavior.

A derivative of the social-cognitive approach is social information-processing. This theory concerns the efforts of individuals to understand themselves and their social

worlds. The individual is seen as trying to make judgments of others. Distortions in these judgements are thought to relate to socially unskilled behavior (e.g, theory of mind research). These studies attempt to provide a sequence of how information is processed from the social environment (Pettit, 1992).

Two methodological issues concern the study of social cognition. First, Shantz (1983) explained that children's social cognition can be studied in two ways, children as *observers* or as *participants*. Secondly, two types of children's knowledge are studied. The first is children's understanding about the *behaviors* of people. The second is children's knowledge about *others as people*. In addition, Shantz (1983) explained that studying children as they participate in real social situations is best; however, these studies are only recently more prevalent.

The next best alternative to real situations is filmed behavior. Filmed behavior is the closest to true life behavior because it is dynamic and event-based rather than static, and allows for summarization of social events in stories or pictures. Filmed behavior asks a child to describe and recall events as they occur by chunking the continuous stream of behaviors into units that make up a larger behavior (Shantz, 1983). This *chunking* of behaviors as described by Shantz (1983) is similar to the behaviors analyzed in this study. Behavior measured at the molar level represents behaviors observed by the average person. Unfortunately, studies examining behaviors at the molar level have not been systematically conducted using film. In summary, the researcher of social cognition must be aware of the role the child plays in the study (is the child an actor or observer?), the questions that are asked of the child (is the child making inferences about people's

behaviors or others as people?), and the methods that were used in the study (is it real life, film, or story?) before generalizing or comparing findings.

The final approach, ethological-attachment theory, has generated studies on aggression, dominance, and, more recently, infant-mother attachment (Pettit, 1992). This theory views the child as active in her or his organization of experience; albeit, within the confines of its biologically derived blueprint of social-development functioning. Bowlby (1958) proposed that the "human infant enters the world preadapted to interact with and respond to a human caregiver" (Bretherton, 1992, p. 134). Bowlby held the belief that infants held an *internal working model* of the self and other in relationships by the end of the first year of life. Through observations and coding, Ainsworth and her colleagues (1978) tested Bowlby's theory. She conducted longitudinal home observations of mother-infant pairs. Her naturalistic narrative records of mother-infant interactions confirmed that the appropriateness of mother responses to her infant signals was related to a more secure attachment relationship.

In summary, of all the approaches, the social information-processing framework has been applied more extensively in autism (theory of mind research). It is assumed that this research would provide the strongest predictions of behavior, as it requires the least amount of inference (Pettit, 1992). While the recent emphasis of the social cognition of children with autism makes the information-processing approach more applicable to understanding social behavior in autism and corresponding deficits in social communication, social cognition, and symbolic play, it does not address relevant

cognitive-developmental aspects of social behavior or the child's ability to master the environment and how this mastery influences social development.

In addition, work by D'Zurrilla and Goldfried (1971), McFall (1982), and Spivack and Shure (1974) propose that social information processing explains social skills and social behavior (Pettit, 1992). While these studies are helpful in suggesting the ways that children process the sequence of social information and where in the sequence problems may arise, they are all based on studies of children with normally developing verbal skills. The extent to which these studies can be applied to understanding the social impairments in autism has not been investigated. Nonverbal, non-parent- or non-self-report measures of social behavior are needed to understand the social impairments in autism. The difficulties in autism suggest both an underlying processing problem of social and communicative information (cognitive-developmental) and a problem of judgment (social information-processing).

Methodological Weakness in the Assessment of Social Behavior and Cognition

Investigators have criticized the assessment methods of both social behavior (Howlin, 1986) and social cognition of individuals with autism (Eisenmajer & Prior, 1991; Volkmar & Klin, 1993). The methodologies employed have been limited in scope. Most studies of the social problems in autism have been confined to easily quantifiable variables, such as the amount of eye gaze or the frequency of peer contact (Howlin, 1986). Qualitative assessments of the social behavior in autism, or research that has investigated the more subtle aspects of the disability, have received little attention in the literature (Howlin, 1986) and are relatively few in number (Dawson & Galpert, 1986).

Besides the studies represented in this review of the literature (Lord, 1984; Van Engeland et al. 1985; Hauck et al.1995; Stone & Lemanek, 1990), research on qualitative aspects of social behavior remains lacking.

Social cognition studies have been criticized for the limited generalizability of findings. First, Eisenmajer and Prior (1991) and Reed (1994) showed that, when social cognition experimental tasks were modified to be clearer and simpler, individuals with autism were more likely to succeed even though they continued to exhibit social behavior impairments. Some experimental tasks confuse social knowledge with actual social use (Volkmar & Klin, 1993). Second, Eisenmajer and Prior (1991), Bowler (1992), and Ozonoff et al. (1991) found that, as verbal mental age increased, the likelihood of passing *false belief* tasks increased. Third, Baron-Cohen (1991a), Baron-Cohen et al. (1985), Eisenmajer and Prior (1991), Ozonoff et al. (1991), Reed (1994) and Reed and Peterson (1990) used subjects who were higher functioning, those with an IQ greater than 69, so that they were able to meet the verbal requirements of the experimental tasks. Even though Baron-Cohen et al. (1985) and Reed and Patterson (1990) claimed that use of a higher functioning group of individuals acts as a more stringent test of the theory and controls for the effects of retardation, Wing and Gould (1979) and Volkmar and Klin (1993) warn that studying only a subgroup of children will produce conclusions with limited generalizability. In addition, this limits research to a small minority of individuals with autism. Because 65- 85% of individuals have mental retardation (Gillberg, 1990; Volkmar & Cohen, 1988) and the symptoms vary among individuals (Bartak & Rutter, 1976; Howlin, 1978; Rutter & Schopler, 1988; Schopler, 1994), the

social cognition of individuals who are at the lower end of the autistic continuum has gone unstudied. Reed (1994) recognized the importance of the unrepresentativeness of her sample and included some individuals with a degree of retardation. Eisenmajer and Prior (1991) recommended that the theory of mind paradigm be adjusted to take into account the differences in levels of severity of autism. In order to assess the social cognition of individuals with autism who are at the lower end of the continuum, alternative methods of assessment must be employed.

Summary of Social Behavior Research

A paradox exists in the findings on the social impairments in autism. Despite deficits in social behavior and social cognition, individuals with autism do not lack sociability. Autism is not defined by the frequency of social contact or the desire for social interaction (Minshew & Rattan, 1992). Research indicates that individuals with autism exhibit both emotional attachment and social interest (Sigman & Mundy, 1989; Sigman, 1994). What is significantly impaired is the quality of social behaviors (Minshew & Rattan, 1992).

Methods of Assessment and Units of Social Behavior

The assessment of social behavior is conducted for various purposes, such as a means to target behaviors for intervention (Carledge & Milburn, 1995) or to increase understanding of social development (Howlin, 1986). More systematic research has been conducted for evaluating treatment effects, such as in social skills programs, than for understanding social behaviors in autism.

Two primary methods have been used to assess social behavior - sociometric techniques and observational measures (Howlin, 1986). Other techniques used less often consist of self-reports, interviews, and social/cognitive tasks. A variety of persons can serve as informants, such as teachers, parents, other adults, peers, and the person with autism. Howlin (1986) summarized the descriptions of social behavior based on these methods as largely vague and anecdotal, and research on the nature of social impairment remains deficient (Waterhouse & Fein, 1991; Volkmar & Klin, 1993).

Social behavior has been measured by quantitative, qualitative, and interactive units (Lord, 1984). Quantitative units are measures based on frequency or duration of behaviors, such as amount of peer contact or eye gaze (asks how often it happens). This is considered to be the simplest level of analysis and the one most often employed (Howlin, 1986). Qualitative units, on the other hand, provide more informative data concerning the highly complex behaviors that are more likely represented during social interaction (Howlin, 1986). These units are often categorical and rely on judgments about the content and meaning of behaviors (asks what is happening) (Lord, 1984). Lastly, interactive units provide information concerning the relationship between different types of behavior during social interchanges (asks how behaviors relate to each other). Interactive measures are more useful for developing hypotheses about successful social interactions (Howlin, 1986; Lord, 1984).

The study reported here used an ecological approach to studying behavior. This observational method sheds light on all aspects of behavior (interactive, qualitative, and quantitative) in the natural habitat and is based on the methods described by Scott (1980).

Shantz (1983) explained that observing social interactions can reveal a child's *explicit* and *tacit* social knowledge and reasoning. The child as an actor *in* the social world, rather than a knower *about* the social world, provides data concerning *social knowledge-in-action-in-context*. The child's own negotiations with others, meanings of social actions, and implicit rules of conduct between people can be inferred from their social behavior (Shantz, 1983). The ecological methods used in this study lend themselves to the study of the development of *social knowledge-in-action-in-context* of children with autism.

Need for Ecological Assessment of Social Behaviors

Many reasons exist for the use of ecological methods to investigate social development in autism. First, Prizant's (1995) overview of the recent 1995 NIH research recommendations on communication and social/emotional development are for (a) more longitudinal studies of children from early to middle childhood to document patterns of communicative, social, and emotional development; (b) further information on the specific roles that unconventional verbal behavior may serve as functional communication and as part of the developmental process; and (c) more data regarding the early patterns of communicative, social, and emotional development to support early identification and diagnosis. A distinct message from the 1995 NIH autism working group review of the research is the need for ecologically valid methods of studying development in order to "capture abilities in everyday situations, as opposed to primarily experimental contexts" (Prizant, p. 2).

Second, individuals with autism who are minimally verbal or nonverbal are not able to meet the expressive language demands of conventional experimental tasks. Such

individuals can be included in this type of investigation, which acknowledges the range of abilities in autism (Bowler, 1992; Howlin, 1978; Wing & Gould, 1979).

Third, an advantage to gathering data from the child's natural habitat, as Miller and Aloise (1989) report, is that laboratory research using experimenter-generated questions and direct questioning elicits fewer references to psychological states of a child than does data gathered from naturally occurring, relevant, and emotionally arousing events. It is also reasonable to expect individuals with autism to be more expressive in their natural environments with familiar people (Wetherby, 1986). Kasari et al. (1993) raised the issue of assessing behavior in limited situations and highlight the need for examining emotional responses of children with autism in various contexts that invoke complex social emotions in other children. Earlier, Hutt and Hutt (1970) emphasized the importance of observing children with autism in their natural habitats and studying the interactions of many behaviors rather than counting individual behaviors (Howlin, 1978). Volkmar and Klin (1993) caution interpretation of findings based on highly artificial experimental procedures, because the "ecological context of relevant social behaviour may be underappreciated" (p.50). Additional problems of equating social knowledge with actual use may occur. Further, it is thought that the tacit social knowledge of children can be inferred from their social behavior (Shantz, 1983). Tacit knowledge represents the procedures and rules that children might know and use, but not be able to state verbally. This social-knowledge-in-action research approach provides important new descriptive data and trends in social-cognitive change as children interact with others (Shantz, 1983).

Lastly, Minshew and Rattan (1992) describe the problems associated with autism as so different in origin from those in other disabilities that the use of interventions appropriate to those other disabilities is likely to fail or worsen the behavior of the individual with autism. They stress that the environment must be adapted to the individual, rather than the converse. This research provides a direct means of studying the environment and the person. Furthermore, increased understanding of social knowledge-in-action-in-context will help identify critical intervention variables that may enhance the social development of children with autism.

Ecological Theory and Research

Barker and Wright (1955) were the first to apply the concepts and methods of ecological psychology to study human behavior (Carlson et al. 1980). This was an original attempt to provide a descriptive basis of human behavior. These ecological studies examined the psychological habitats of children and the structure, dynamics, and content of their behavior at the Midwest Psychological Field Station in Kansas in the 1950s.

The need for ecological research is evident from the fact that even though psychological science has provided an understanding of laws of behavior, little is known about the distribution of behavior. Such information is available as "If a one-inch red cube is placed on a table before an eight-month-old infant, then he will attempt to grasp the cube" (Barker & Wright, 1955/1971, p. 1); but no data exist concerning how often a child is offered a red cube. Barker and Wright (1955/1971) concluded that we know a substantial amount about how people behave in certain conditions, but little about the

existence or distribution of the conditions outside of laboratory settings. Much of the same can be said for the research on autism.

The methods used in ecological research involve the recording of the stream of behavior, dividing the stream into units, and analyzing the units (Wright, 1967). Barker (1963) explained that the stream of behavior is made up of innumerable parts, but that these parts can be classified in one of two types if the temporal aspects of behavior are considered. The first type, behavior units, are observed independently of the investigator's influence. The second type, behavior tesserae, are the selected fragments of behavior used for a particular investigation. Barker clarified that "alpha waves, psychotic episodes, and games are behavior units" (p.1) and "maze-learning trials, five-minute segments of behavior, and answers to pollsters' questions are behavior tesserae" (p.2). Behavior tesserae are the result of interruptions in the natural behavior stream that occur when the investigator employs a predetermined time period or a certain number of behavioral occurrences to define the behavior stream. These studies depict small sequences in a mosaic that results in a fragmented view. The social cognition studies of theory of mind are examples of behavior tesserae, as for example, when the investigator asks the child to perform in some way using experiments, tests; questionnaires, and interviews (Barker, 1963). Social behavior data that consists of the intrinsic structure of the behavior stream in the natural habitat, behavior units, have not been recorded in the autism literature. The methods of narrative coding have been described by Scott and her colleagues (Scott, 1980; Carlson et al. 1980), and employed in various studies (Bowman, 1980; Hatfield, 1982; Rager, 1986; Scott, 1977, 1989).

One study by Dyck (1963) examined the social contacts of normally developing children using ecological methods. Narrative records called specimen records (described in the methodology section) were collected on six preschool and six children of school age. Three sets of variables were studied: (a) variables associated with persons, (b) variables associated with behavior occurring within the social contact unit, and (c) variables associated with situations. Dyck (1963) found that the 12 children engaged in 4,723 social contacts with their parents over 12 days. Preschool children had more social contacts with their parents than school age children. Contacts with mothers exceeded contacts with fathers. Parents made social contacts with girls as much as with boys. Almost all the children originated more contacts with parents than vice versa. Mothers originated more contacts than fathers, but not significantly more. Teachers originated more contacts with the school age children than the parents. The reason for the contact was mainly a response to the activity of the child. Teachers exceeded parents in seeking an activity for the child. Parents exceeded teachers in (a) seeking an activity with the child, (b) expressing themselves about the child, (c) responding to a request of the child for activity, (d) responding to a request of the child for activity with them, (e) responding to the overt expression of the child, (f) responding to the state of the child, (g) responding to the activity of the child, and (h) failing to respond to the child. No differences were found between parents and teachers in (a) seeking to express themselves to the child, (b) seeking an expression on the part of the child, and (c) responding to a request for information.

Dyck (1963) also examined the five cultural situations common to homes: (a) getting up and getting ready for the day, (b) having breakfast, (c) having lunch, (d) having supper, and (e) going to bed. Contacts that occurred at these times were judged as to whether or not they were *appropriate, necessary and fitting*, and if so, they were labeled *ritual-related contacts*. He found that 38% of the parent-child contacts occurred during these times and that 51% of these contacts were ritual-related. Mothers and fathers did not differ in the proportion of their contacts in the cultural situation. Both parents were simultaneously present most frequently at dinner time. Mothers exceeded fathers in the number of ritual-related contacts, and 73% of ritual-related supper contacts were mother-child interactions. Teachers' ritual-related contacts refer to the business of the classroom. On the average, 93% of the teachers' contacts and 46% of the parents' contacts were ritual-related. Dyck's study provides a rich description of children's social contact in their natural environment.

Similar research with individuals with autism is essential if we are to gain a fuller understanding of social behavior in autism and develop more effective means of intervention. Current problems with the generalization of social skills and the limitations of analogue research warrants this research. Scott's (1980) observation that descriptive data on human behavior continues to be lacking despite the recognition of the complexity and interdependence of variables in the natural habitat also pertains to the literature on social behavior in autism. Research that reflects this interdependence is crucial. The ecological approach applied in this present study provided systematic descriptions of

interactive, qualitative, and quantitative differences (Scott, 1980) in social behavior of children with autism and children of comparable developmental levels.

Summary and Conclusions

Social skills are perhaps the most critical behaviors in terms of long-term quality of life for people with autism. Adult outcomes such as community inclusion and mental health status are directly related to social skills and positive peer friendships (Chadsey-Rush, 1990; Hartup, 1983; McEvoy & Odom, 1987; Mesibov, 1984; Smith, 1990; Wing & Gould, 1979).

This study is significant for three primary reasons. First, the study of social development in autism will aid researchers by attempting to understand the basic nature of the disability (Klin, Volkmar, & Sparrow, 1992). Second, it overcomes limitations of laboratory studies. Third, a greater understanding of social development, a key aspect of the disability, will help professionals and families design more appropriate and meaningful interventions and treatments. Ecological methods provide a link in the bidirectional relationship between the individual and the environment (Scott, 1980).

This study provided a descriptive basis for behavior that will help create a foundation to identify natural components of the social behavior impairments in autism. Additionally, it will help clarify the gap between social interest and social abilities of individuals with autism.

CHAPTER III

Research Questions

The most general form of the research question investigated in this study was "What is the naturally occurring behavior of children with autism in their own natural habitat? A second general question was "How do the behaviors of children with autism compare with those of children with Down syndrome?"

More specific research questions were:

1. How do structural parameters of the behavior of children with autism compare to those of children with Down syndrome?
2. How do qualitative and interactive parameters of child-specific behaviors of children with autism compare to those of children with Down syndrome?
3. How do qualitative and interactive parameters of the environment of children with autism compare to those of children with Down syndrome?
4. How does the structure of the environment relate to the structural, qualitative and interactive parameters of the behavior of the children with autism and the children with Down syndrome?

CHAPTER IV

Methodology

A naturalistic observational design was used for the study reported here. Parameters of behavior during structured and free times at home were compared between children with autism and children with Down syndrome. Structured settings (dinner time and homework time) were selected, as findings from previous research has suggested that children with autism perform better and are more socially responsive in structured and predictable environments comprised of organized and repetitive activities (Bartak & Rutter, 1973; Clark & Rutter, 1981; Ferrara & Hill, 1980; Lord, 1984; Rutter & Bartak, 1973). Unstructured settings (free and open activities) provided a comparison point from which to examine the range of behaviors produced by the children.

Participants

Five selection criteria were used to maintain homogeneity within the sample: diagnosis, adaptive behavior level, general cognitive level, gender, and age (see Table 3 for demographic characteristics). Each criterion is discussed separately for the autism group and then for the Down syndrome group, in terms of rationale for its selection and measurement strategies.

Autism Group

Eight participants with autism from 6 to 10 years of age were recruited from personal contacts within the Autism Society of Indiana (ASI) and local school districts (Monroe County and Marion County, Indiana). The general recruitment procedure was to contact

Table 3
Participant Characteristics

Child	Age	VABS[1]			IQ
		Social	Communication	Daily Living	
Autism					
Matthew[2]	10.6	52	40	19	40
Bill	10.1	32	21	19	NA[3]
Brian	6.2	49	37	19	NA
Freddie	8.6	45	44	52	54
Richie	6.9	58	42	47	55
Ken	8.9	45	19	19	NA
Rusty	7.4	63	59	59	71
Scotty	9.3	43	27	29	NA
Down syndrome					
Brandon	9.1	49	33	19	25
Alex	9.9	42	42	52	40
Michael	9.8	56	32	50	NA
Trey	6.8	73	56	55	50
Jay	8.0	99	57	67	41
Toby	8.9	74	44	74	39
Jim	7.6	87	44	54	49
Pat	9.4	51	24	24	44

[1] Vineland Adaptive Behavior Scales
[2] All names are code names
[3] NA=not available (see text for explanation)

parents directly or by classroom teachers. Direct contact was allowed because the researcher had personal knowledge of many families due to her involvement with the ASI. The indirect procedure involved contacting the special education directors of Marion and Monroe County and requesting names of teachers of students with moderate to severe disabilities. The researcher contacted these teachers directly via telephone and explained the nature of the study. A follow-up letter explaining the research was provided to the teachers (see Appendix C). If the teachers felt that some parents might agree to participate, the teachers forwarded a parent letter and informed consent form to the parents of children with autism (see Appendixes C and D). This same procedure was used to recruit children with Down syndrome. If parents agreed to participate, they completed the informed consent form and sent it to the teacher or directly to the researcher. If the teacher obtained the form, she provided the parent's phone number to the researcher by phone or by mail with the informed consent statement signed by the parent. Parents were contacted by phone and provided more information regarding the study, including the purpose, procedure, and an explanation of the risks and benefits for participation. All parents received $25.00 for participation.

Of the group with autism, only children who met the DSM-IV criteria for Autistic Disorder and for mental retardation (American Psychiatric Association, 1994) were recruited (see Appendixes A and B for diagnostic criteria). None of the children had a corresponding disability such as blindness or deafness. All children were enrolled in programs for students with moderate to severe disabilities.

Diagnosis, Cognitive Level, and Adaptive Behavior Level

Only individuals who had autism *and* mental retardation were used in the present research as this group represents 65 - 80% of individuals with autism, and this group has been excluded from almost all previous social cognition studies. Participants who met the criteria for Asperger's Disorder or Pervasive Developmental Disorder Not Otherwise Specified were not included. Children who had been previously diagnosed with autism by qualified persons (e.g., licensed psychologist, certified school psychologist) not connected with this study and who had cognitive levels approximately 2 standard deviations below the mean (IQ less than or equal to 70) based on previous formal and informal assessments were selected. See Table 3 for individual IQ scores and Table 4 for t-test analyses of demographic characteristics. Many cognitive assessments had been used to assess intellectual level. These measures included the Bayley Scales of Infant Development, the Stanford-Binet, 4th Edition and Form L-M, the Slosson Intelligence Test, the Kaufman Brief Intelligence Test, the Differential Ability Scales, and the Wechsler Intelligence Scale for Children. Four individuals with autism and one with Down syndrome did not have formal IQ test results. A review of previous psychological assessments indicated that attempts were made to administer standardized IQ tests without success. The developmental level of these children were reported and rated significantly below their chronological ages. Their Vineland Adaptive Behavior Scales (VABS) scores were consistent with the other children and described in the next section.

Adaptive behavior was assessed via the VABS, Interview Edition. The observer administered the VABS to the child's parent during the first visit to the home (see Table

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3 for adaptive behavior levels for each child). Adaptive behavior was consistent with reported cognitive level. Further importance of the adaptive behavior measure as a selection criteria is described in the section describing the children with Down syndrome.

Gender

Only males were recruited for this study in order to control for possible gender effects and because autism occurs four times more frequently in males than in females.

Age

The age requirement was based on previous studies of the development of social cognition in normally developing children. In Wimmer and Perner's (1983) original study of theory of mind in normally developing children, the authors concluded that "a novel cognitive skill seems to emerge within the period of 4 to 6 years" (p.126). Harris (1990) summarized social cognition research performed in the United States, the United Kingdom, and Austria and noted that between the ages of three and five, there is a marked shift in the development of theory of mind. By the age of six, normally developing children are able to anticipate the thoughts and beliefs of others.

The research on autism is less clear. Baron-Cohen (1991) claimed that individuals with autism who were able to pass theory of mind tasks were delayed by at least six years. This suggests that for individuals who are high functioning, i.e., those without mental retardation, theory of mind might develop around 12 years of age. Holroyd and Baron-Cohen (1993) reassessed 17 individuals with autism using the Sally/Anne test after seven or eight years (mean age of subjects at the time of initial testing was 12.2

years, and at follow-up was 19.8 years) and found that the majority of individuals failed at retesting.

Another confusing aspect of the variable of age is that it has not usually been carefully considered in relevant studies. Data have been generalized from individuals of a range as narrow as 6 to 16 years old (Baron-Cohen et al. 1985) to as wide as 8 to 45 years old (Happe, 1994). By sampling 6- to 10-year-old children, the research reported here focuses on a less diverse group of children. It allows for comparisons of social behavior and tacit knowledge (rules of social behavior that children might use but not be able to articulate) between children matched by age, and by social, verbal and cognitive skills (i.e., children who are likely to have this social-cognitive skill compared to children with autism who are likely to not have this skill).

Down Syndrome Group

The same selection criteria for the children with autism were applied to the comparison group, except for diagnosis. Eight male participants with a previous medical diagnosis of Down syndrome, between 6 and 10 years, and of comparable cognitive levels were recruited from primarily four sources: Franklin, Marion, and Monroe County school districts in Indiana, and Riley Child Development Center in Indianapolis. All children had been diagnosed by qualified medical personnel. All children were served through programs for students with moderate to severe disabilities. To ensure parent confidentiality, the same recruitment procedure used for the group with autism was applied. Administrators or agency staff were asked to contact parents directly about the research project. Parents who expressed interest were then contacted by the researcher. A

copy of the letter sent to parents and teachers describing the study is attached in Appendix C. None of the comparison group children with Down syndrome had any other developmental disabilities, such as blindness, deafness, or cerebral palsy.

Diagnosis, Cognitive Level, Adaptive Behavior Level

In addition to a diagnosis of Down syndrome, these children were identified as having associated mental retardation. Previous cognitive assessments conducted by qualified professionals (certified school psychologists, licensed psychologists) were used to validate mental retardation (see Table 4 and Appendix B for APA criteria for mental retardation). The children had adaptive communication and daily living skills comparable to the children with autism.

The communication selection requirement was important because children with autism often have delayed language development (Sigman, 1994; Mundy, Sigman, & Kasari, 1990). If they are compared to children based on their performance abilities only, they are likely to have language abilities inferior to the comparison group. In contrast, if they are selected only by language skills, they are likely to be superior in performance abilities (Sigman, 1994). In order to control for these effects, it was important to select the children with autism and the comparison group children on both performance and language development (Minshew & Rattan, 1992). Therefore, matching children by verbal ability limits the possibility of finding differences. Also, research has shown that although individuals with autism perform worse on emotion recognition experimental tasks than other groups, differences among groups are smaller and usually not significant when groups are matched based on their verbal abilities (Sigman, 1994).

The demographic variables were compared using the t-test (see Table 4). The two groups of children did not differ in chronological age (CA). When available, standardized test scores were obtained and statistically compared. Five of the children did not have any formal standardized IQ score. A review of previous psychological reports indicated that these children had overall developmental levels significantly below their chronological ages. Behavioral observations described in the psychological reports indicated that standardized testing was attempted but not successful. Thus, IQ scores were not equal between groups but generally similar. No lower cut-off level of IQ was applied to the subject selection criteria. Both groups of children were primarily served in classrooms for students with moderate and severe disabilities. Based on adaptive behavior scores in the areas of communication and daily living skills using the Vineland Adaptive Behavior Scales, no significant differences were found between the children. A significant difference was found in the socialization domain. Children with autism were reported to have lower adaptive social behavior skills than the children with Down syndrome.

Procedures

Settings

Participants were observed in their natural habitat at home. The children were observed during structured activities (dinner) and during free and open activities at home (before dinner and after dinner). Each child was observed for approximately two hours.

Table 4
T-test Analysis of Demographic Characteristics

Measure	Autism	Down syndrome	t	p
Age (years)				
M	8.5	8.7	-.28	.79
SD	1.6	1.1		
Range	6.2-10.7	6.8-9.9		
N	8	8		
IQ				
M	55	41	2.2	.05
SD	12.7	8.3		
Range	40-71	25-50		
N	4	7		
Vineland Domains				
Communication				
M	39.0	42.8	-.54	.96
SD	15.2	12.4		
Range	21-71	25-57		
Socialization				
M	48.4	66.4	-2.3	04*
SD	9.6	20.1		
Range	32-63	42-99		
Daily Living				
M	32.9	49.4	-1.8	09
SD	17.0	19.1		
Range	19-59	19-74		
N	8	8		

*p<.05

Observations

Ecological methods of narrative recording in the natural environment were applied to study the "stream of behavior" of individuals in their home (Barker, 1963). Before observations were initiated, a two-step process took place. First, the participants were oriented in their homes. The families were informed about the purpose of the study, the

methods of the observations, the data to be collected, and the equipment used. Parents or caregivers also completed the Vineland Adaptive Behavior Scale - Survey Form and a semi-structured interview (see Appendix G). The interview helped identify family members who would be present during adaptation and the final observation. The children were allowed to look at and examine the stenomask. Orientation was performed just prior to the second-step of adaptation.

In the second step, the family adapted to the observer's presence. During adaptation, the experimenter followed the child, spoke into the stenomask, and recorded the behavior until the child and all other people in the environment adapted to the equipment and the presence of the observer. Scott's (1980) criteria for adaptation was applied. Adaptation occurs when the observer acts as a nonresponding piece of the environment and results when the child and the people in the environment stop noticing the observer (Scott, 1980). If questions were asked, the observer slowly looked away (see Appendix D for hints to observers). It took approximately two 2-hour visits to gain adaptation. Barker and Wright (1967) found that children under the age of 10 easily adapted to the observer's presence, which was confirmed in the present study. Observers were assigned to families as families were recruited and not randomly distributed to groups.

The Chronolog

Chronolog records provided the data for analysis, and Scott's (1980) steps for chronolog data collection were followed. The chronolog concept is derived from Barker and Wright's (1971) "specimen record." Chronologs are ongoing narrative records of

behavior at a larger molar level as described below, whereas a specimen record describes behavior at a more elemental molar level (Barker & Wright, 1967). Scott (1980) explains:

> Rather than recording the individual acts involved in making a telephone call and the verbatim conversation of the subject, the chronolog summarizes the ongoing gist of the behavior, while still recording only directly observable behaviors, e.g., "Jack made a phone call, he talked to Mark about the workshop on Saturday." (p. 288)

The behavior of the people around the child and the ongoing events are described and provided in the chronolog descriptions as context (see Appendix F for general instructions to observers). In the margin of the chronolog, time notations are made. A sample chronolog is provided in Appendix H. About 2 hours of observational data per child translated into approximately 50 pages of chronolog data for each child..

The advantage of the chronolog is that it is easier to collect than a specimen record, while still maintaining the basic principles of recording behavior in the natural environment (Scott, 1980). The reliability of chronologs, the ability of different observers to record the same behaviors, is relatively good, ranging from .83 to .89 (Scott, 1980).

Apparatus

A stenomask was used to collect the chronologs (Schoggen, 1964). The stenomask is a recording device that covers the lower half of the face, quieting the observer's comments and allowing the observer to unobtrusively record all ongoing events in the environment onto an audiotape. The stenomask is connected to a portable tape recorder

and has a switch which allows the recorder to be turned on and off unobtrusively. A stop watch was used for time notations.

Observer Training

The experimenter and five graduate students collected the chronolog records. A colleague with extensive experience in the collection and analysis of narrative records provided primary training. Records from each observer were critiqued until criteria established by Barker and Wright (1955/1971) were met. The training protocol for observers is described in Appendix J.

Data Analysis

Unitization. The first step in chronolog analysis was to unitize the stream of behavior into its naturally occurring structural units (Scott, 1980). Activity units (AUs) have been the main structural units used in chronolog analysis in the literature (Argenbright, 1990; Bowman, 1980; Hatfield, 1982; Rager, 1986; Scott, 1980). An activity unit is a naturally occurring chunk of behavior from the perspective of the actor and occurs along a constant psychological direction (Scott, 1980). Activity units have a clear beginning and end point (see example of a unitized chronolog in Appendix H). When the actor engaged in a distinct activity, a new unit was marked. At any time, however, overlapping units may be occurring (see example in Appendix H). Once the behaviors were unitized, each was given a label that represents the activity. Appendix H provides an example of labeled AUs, such as "eating dinner" and "asking for drink."

Reliability of Unitization

The reported reliabilities of AUs are high and range from the high .80s to the low .90s (Argenbright, 1990; Hatfield, 1982; Rager, 1986; Scott, 1980). For this study, two reliability analyses were conducted at different points during unitization, the first reliability was calculated approximately one-third of the way into data analysis (after four observations were unitized) and the final reliability was calculated two-thirds of the way into data analysis (after 8 observations were unitized).

Because reliability in ecological research is more complicated than standard laboratory research, the Scott and Hatfield (1985) procedure was applied (see Scott & Hatfield for formula and Appendix J). This reliability formula takes into account the duration of behavior as part of the analysis, thus, making it more ecologically valid. Approximately 45 minutes of data was analyzed for each interrater reliability analysis. High reliabilities of 95% and 89% were obtained from the two samples in the present study. Differences in unitization were reconciled.

Categorization

After the AUs were identified and reliabilities obtained, the second step was to categorize each unit. The categorization procedure for the AUs is explained below.

Categories

Twenty-three category codes were applied to the AUs. See Table 5 for a list. A full description of each of the categories is provided in Appendix I. Some of the categories were selected because they have been applied in previous ecological research (Barker & Wright, 1955/1971; Scott, 1980). Of the 23 codes, 7 were developed for this study. These

codes included (a) general intent of AU from child's perspective, (b) intensity of effort put forth by child and by partners, (c) setting, (d) duration of other's involvement, (e) continuity of other's involvement, (f) goal achievement, and (g) difficulty judging purpose of AU.

Reliability

Two independent readers coded the AUs using a code book of categories (see Appendix I). Two separate reliability analyses were obtained, about one-third and then two-thirds of the way into data analysis. About 60 minutes of chronolog data was analyzed per reliability analysis. Two judges coded the AUs then compared their codes. Differences were reconciled. Table 5 shows the results of reliability analysis for the coding categories. The mean of all reliabilities met an acceptable level, ranging from 80 to 100% agreement, with the exception of termination of AU and continuity. The reliability of termination of AU has been noted as problematic (M. M. Scott, personal communication, August, 1997) because of the nature of terminated behavior, and not necessarily because of poor interrater reliability. The reliability of the continuity code was sufficiently low that it was dropped from further analysis.

Data Structure

Data derived from ecological research methods are different from those derived from traditional laboratory experimental research in several ways (Scott & Hatfield, 1985). First, due to nature of ecological data, the length of narrative records are determined by natural boundaries within the setting rather than by predetermined time limits established by the researcher. Second, the number of activity units are determined by the child, rather

Table 5
Percentages of Interrater Agreement for Categories

Category Code	Analysis 1[a]	Analysis 2[b]
Length of AU	96	93
Type of Overlap	92	100
Total Number of Overlap	100	100
Initiation of AU	100	87
Termination of AU	92	74
Affect of Child	100	100
Primary Person Involved	92	94
Secondary Person Involved	100	90
Affect of Primary Person	94	90
Affect of Secondary Person	100	87
Intent of AU	81	91
Mechanism Used by Child	86	89
Mechanism Used by Primary Person	84	89
Mechanism Used by Secondary Person	100	81
Intensity of Effort of Child	94	94
Intensity of Effort of Primary Person	100	90
Intensity of Effort of Secondary Person	100	87
Sociality of AU	91	97
Duration of Other's Involvement	90	99
Continuity of Other's Involvement	71	41
Goal Achievement	84	81
Difficulty of Judging AU	84	81

[a] Percentage agreement collected one-third of the way into data analysis

[b] Percentage agreement collected two-thirds of the way into data analysis

than the researcher, in order to capture the naturally occurring behavior of the child. Third, as a result of unequal observation times and unequal numbers of activity units, "raw" data are converted into proportional data to allow comparison between children. Finally, because the temporal aspects of the behavior structure are obtained, time can be accounted for in a conversion formula for relevant categories. Proportional data were used for subsequent data analysis. Proportional scores, as cautioned by Bauernfeind (1962), are ipsative, meaning the sum of the scores is always 100%. Caution should be used in the interpretation of proportional scores, as ipsative data limit the degrees of freedom available by assigning one proportion to an activity unit (AU) and, thus, restricting further assignments to the data.

In order to generate the proportional data, two types of transformations were applied depending on the nature of the behavior being coded—a time-weighted formula or a frequency-based formula. Both of these formulas created proportional or percentage scores, but they differ in the large whole to which they refer. Time-weighted percentages are proportions of total AU time, whereas, frequency percentages are proportions of the total number of AUs.

The time-weighted formula was used to transform data describing behavior that occurred throughout a particular unit. When deciding whether to apply the time-weighted formula to a category, the question "How are these data best described?" was asked. For example, the category, *intention of the child during the AU*, was judged to portray a variable that occurred throughout an entire AU, while another category, *initiator of the*

AU, was judged to represent a behavior that occurred only at one point in AU. Thus, "How much time during the behavior stream did a child show a certain intention?" can be answered using the time-weighted formula, but "How often did the child initiate?" requires the frequency-based conversion which is described below. Other continually-occurring behaviors that were transformed using the time-weighted formula were (a) length of AU, (b) number of overlapping AUs, (c) type of overlapping AUs, (d) child's affect within the AU, (e) the level of intensity of the child's behavior, (f) the sociality of the AU or the degree to which other people were present, (g) the duration of other's involvement in the AU, and (h) the continuity of other person's involvement in the AU. All other variables were transformed using the frequency-based formula described below.

The frequency-based formula was used to transform data representing variables that described more discrete characteristics of the AU. These variables were derived by adding the frequencies of like-coded categories. The sum of the frequencies were divided by the total number of AUs for a particular child. Categories judged to represent more discrete components of the behavior stream were (a) initiation of AU, (b) termination of AU, (c) primary person involved in AU, (d) secondary person involved in AU, (e) expression of affect of primary person, (f) expression of affect of secondary person, (g) mechanism used by child, (h) mechanism used by primary person, (i) mechanism used by secondary person, (j) intensity of effort of primary person, (k) intensity of effort of secondary person, (l) goal accomplishment, and (m) difficulty judging purpose of AU. These categories represented behaviors that occurred at points during the behavior stream rather than throughout. This distinction is not always clear.

For example, expression of affect of partners, mechanisms used by partners, and intensity of effort of partners could be argued to be more continuous variables and hence better represented by time-weighed proportions. The content of the data, however, suggested that these variables were often episodic and more or less discrete features of the AUs. A dad might interact with the child momentarily by saying, *hello* then return to reading his book. Mom might tell the child to scoot back from the TV, then return to cooking dinner. In order to be consistent, variables that were more episodic were deemed frequency-based proportions.

The proportional or percentage and raw data were analyzed via parametric statistics. Ecological data collected in earlier times relied on nonparametric tests. However, because of the report of the robustness of parametric tests in regard to violations of assumptions (Glass & Stanley, 1970), parametric statistics were applied. Parametric techniques are more powerful tests than nonparametric alternatives. The t test, for example, uses more information from the data and is more likely to detect true differences between two populations more often than its nonparametric counterpart, the Mann-Whitney *U* test (Norusis, 1990). The Mann-Whitney *U* test substitutes ranks for actual values, possibly losing potentially useful information. For all t-test analyses, two-tailed tests were utilized.

Because multiple individual pairwise comparisons were conducted, the Bonferroni procedure was applied in order to protect against the risk of Type I error (false positives) and to minimize the experiment-wise error rate. The upper boundary of the probability of rejecting the null hypotheses was determined separately for each category by dividing

alpha ($p = .05$) by the number of comparisons (Kazden, 1992) of that category. The Bonferonni correction was applied by category because it was thought to be more logically appropriate for ecological data. It provides statistical correction, and it allows for differences to be found without overly penalizing the data.

Chapter 5

Results and Discussion

Behavioral Output

A total of 31 hours and 31 minutes of observational data were collected. Behavioral output data by child diagnosis are presented in Table 6. Observation time per child averaged 1 hour and 58 minutes, with minimal variation among children (1'46" to 2'07"). No significant difference was found between groups based on observational time ($t = 0.30$, $p = .77$).

The numbers of AUs were compared for the two groups of children and a trend was revealed ($t=2.1$, $p=.07$) for boys with autism to have more AUs than the boys with Down syndrome. AU time, the sum of the durations of all the AUs, provided another attribute of behavior output. Because it was possible for children to be involved in more than one AU at a time, in overlapping patterns, AU time exceeded observational time. AU time varied considerably from 1 hour, 58 minutes to 6 hours, 41 minutes, with a mean length of 3 hours and 12 minutes and a total length of 51 hours and 9 minutes. No significant difference was found between groups using AU time ($t = -.54$, $p = .59$).

In summary, because no significant differences were found between groups based on observational time or AU time, differential results in terms of AU structure or quality are likely not artifacts resulting from varying amounts of observation time or AU time between children with autism and children with Down syndrome.

Table 6
Behavioral Output Data

Diagnosis	Observation Time	Number of AUs	AU Time
Autism			
Matthew[1]	1:46	46	1:58
Bill	2:04	139	2:50
Brian	2:07	137	2:26
Freddie	1:52	55	2:26
Richie	1:57	95	6:27
Ken	2:00	51	2:32
Rusty	2:01	69	2:25
Scotty	2:03	118	2:58
Total	15:50	710	24:01
Mean	1:58	89	3:00
Down syndrome			
Brandon	1:53	59	3:13
Alex	1:51	69	2:18
Michael	2:07	77	6:41
Trey	1:53	43	2:34
Jay	2:00	57	3:19
Toby	2:00	61	2:49
Jim	2:00	60	3:47
Pat	1:59	46	2:28
Total	15:43	472	27:08
Mean	1:58	59	3:24
Overall Total	31:33	1182	51:09
Overall Range	1:46 - 2:07	43 - 139	1:58- 6:41
Overall Mean	1:58	74	3:12

[1]All names are code names

Structured Versus Unstructured Settings

One of the original research questions of this study was the effect of structure of the environment on child behavior. Previous research has documented that children with autism are more responsive in structured and predictable environments comprised of organized and repetitive activities (Bartak & Rutter, 1973; Clark & Rutter, 1981; Ferrara & Hill, 1980; Lord, 1984; Rutter & Bartak, 1973). Two settings at home were observed in order to determine the influence of environmental structure on the behavior stream. Dinnertime and free and open activities were selected as structured and less-structured settings, respectively.

Before chronolog analysis ensued, many questions about the preconceptions of structure of dinnertime and free time became evident. The setting of dinnertime was generally observed to be loosely structured, extremely variable from family to family, and different from child to child. For example, many families did not have a time when all members ate dinner, and the time of dinner varied often from day to day, depending on who was home that evening. In addition, some children were observed to prepare their own dinner by microwaving frozen meals. Sometimes a child ate by himself with the mother checking on the child intermittently.

Similarly, free and open activities were also variable. Children were observed to play games, watch TV, and play by themselves. When children were playing games with parents, this was often a highly structured activity. Parents almost always kept the activity moving from the beginning to end, providing many supports.

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In order to statistically examine the validity of these observations, that structure type would not differentiate groups of children, a sampling of the category codes was analyzed based on dinnertime behaviors and free and open activity behaviors. Of 28 variables examined, only 3 variables were significant. After experimentwise error was adjusted using Bonferroni technique, no variables remained significant.

The prior view that structured and unstructured settings could be encapsulated as dinnertime and free and open activities appeared problematic. Home routines often became systematic through familiarity, predictability, and practice. Routines that were directed and organized by adults were often equivalent to high structure. The construct of structured verses unstructured settings seemed to be operating differently at home than had been suggested by previous literature based mainly on school settings. This finding is important for future research examining behavior of children using structure as an independent variable. Due to this finding, further data analysis did not include structure type.

Structure of the Behavior Stream

Length of AUs

Each AU was marked to the nearest .25 minute, and the length of AUs by diagnosis was examined descriptively and statistically. While the mean length of the AUs was 2'35", the median length was 30", and the modal length was 15". Of the total 1,182 AUs, 542 15-second AUs occurred, indicating a high percentage of very short AUs. The finding of a high number of very short AUs of one minute or less in length and few longer AUs has been reported in other studies of ecological data (Barker & Wright, 1971;

Dumke, 1986; Scott, 1977; Scott, 1997; Wright, 1967). No difference in total AU time was revealed between groups (t=-.54, p=.59).

Statistical analysis of the length of AUs per minute (duration of AUs / observation time) revealed no significant difference (t= -.57, p=.59), with a mean proportional rate of 1.5 AUs / minute for the children with autism and 1.7 AUs / minute for the children with Down syndrome. Analysis of the length of AUs divided by the number of AUs revealed a significant difference (t=-2.4, p=.03). The mean length of AUs was 2'16" for the children with autism and 3'24" for the children with Down syndrome. Children with autism exhibited AUs of approximately 1 minute less in duration. In Wright's (1967) ecological study of 12 children who were typically developing and 5 who were physically disabled children, he found a significant correlation between age and mean length of duration of units, suggesting shorter AUs are observed in younger children. Comparing this finding to the present study, children with autism appear even more developmentally immature when compared to the chronological-aged and mental-aged matched group of children with Down syndrome.

Number of Overlapping AUs

The number of overlapping units is a measure of the simultaneity or co-occurrence of activity units. The co-occurrence of AUs is an important characteristic of the behavior stream and is thought to reflect developmental maturity (Wright, 1967). The ability to initiate, engage, and disengage in one activity that is consistent across some time period demonstrates the ability to organize behavior, and, in this sense, the AU may be seen as the ability of the child to produce goal directed behavior, or behavior with an intention..

Webster (1988) defines intention as determination to do a specified thing, having something in mind as a plan and directing all efforts toward this plan. The finding of overlapping AUs in children with autism and children with Down syndrome shows clearly that both groups can produce behavior toward multiple intentions simultaneously. Information on the ability to perform multiple behaviors that reflect varying intentions has not been heretofore available in children with autism and Down syndrome.

Of the total 1,182 AUs, 20 percent (232) did not overlap at any point with any other AU, about 50 percent (584) overlapped with one other AU, and approximately 19 percent (23) had 2 overlaps. Only about 12 percent (136) had more than 2 overlaps. While the children with autism displayed a slightly larger total number of overlapping AUs (937) compared to the children with Down syndrome (916), the difference between groups was not significant ($t=.11$, $p=.92$). In contrast, a t-test of percentage scores (sum of the total number of overlapping AUs for each child / # of AUs for each child) indicated that the children with Down syndrome had significantly more overlapping units (mean of 2.0) than the children with autism (mean of 1.3) ($t= -2.85$ $p = .01$). Table 7 provides a description of the mean number of overlapping AUs by diagnosis. This finding suggests that the AUs of the children with autism were more discrete in structure. Wright (1967) found that older children consistently showed a higher degree of connectedness among units. Older children were better able to keep more than one activity going at a particular time and were able to begin a new activity while completing a previous one. He also found no difference between the children with physical disabilities and the typically developing children. In the present study, in contrast, the

children with autism, appear to be more developmentally immature than the children with Down syndrome in their ability to engage in more than one activity at a time.

Table 7
Percentages of Number of Overlapping AUs by Diagnosis[1]

Diagnosis	Mean	SD	t	p
Autism	1.3	.30	-2.85	.01
Down syndrome	2.0	.46		

[1]Calculated as a % of each child's total AU time.

Type of Overlap

The type of overlap reflects the complexity of the structure of the behavior stream as children engaged in one or more different AUs at a time. When an AU is nonoverlapping, the child's intention was to accomplish one goal; however, when an AU overlapped with another AU, the child's intentions were to perform two different actions simultaneously. The chronologs from a child with autism and a child with Down syndrome are attached in Appendix H and provide examples of overlapping and nonoverlapping AUs. In Richie's record, AU 49, "eating dinner", overlaps with AUs 51 through 54, reflecting Richie's intentions of *asking for help/permission*, *responding to his grandpa*, and *failing to respond* at the same time as *eating dinner*. In the same record, AU 55, *cleaning up after self* is a nonoverlapping unit that occurred from 38'18" to 39'24". Other examples of types of overlapping AUs are shown in Trey's record in Appendix H.

Of the total 1,182 AUs, 20 percent (237) represented isolated or nonoverlapping, 11 percent (131) enclosing, 55 percent (653) enclosed, and 13 percent (153) interlinking AUs. Only 0.7 percent (8) of the AUs were characterized as interrupted. These findings are consistent with Wright's (1967) findings that the majority of units were enclosed. When the structural categories of isolated, enclosing, enclosed, and interlinking were converted using the time-weighted formula and compared based on diagnosis (length of like-code AUs / total AU time for each child), results indicated no significance for duration of nonoverlapping ($t=.38$, $p = .71$); enclosing ($t=.43$, $p = .67$); enclosed ($t=-.35$, $p = .73$); interlinking ($t=.50$, $p = .62$); and interrupted ($t=-2.05$, $p =.08$) AUs. An interesting but nonsignificant finding was that when the frequency-based formula was applied, there was a trend toward children with autism showing more isolated ($t=2.0$, $p =.06$), more enclosing ($t=2.7$, $p=.016$), and fewer enclosed types of overlapping intentions ($t= -2.7$, $p=.017$). These latter two analyses were judged as nonsignificant because when the alpha level was adjusted to account for experiment-wise error (.05/5), the new alpha was set at .0125 (see Table 8). Wright (1967) found a negative correlation between enclosing units and age and a positive correlation between enclosed units and age. Wright summarized that "the behavior of the older children occurred in fewer but longer segments (represented by enclosed units), which means that older children managed to maintain goal-directed actions with greater persistence in the face of potentially interrupting action units" (p.120). Children with autism were less able than their chronological-aged and mental-aged counterparts to engage in longer goal-directed

AUs with persistence; the mean percentage rate of enclosed units for children with autism was 51% and for Down syndrome was 64%.

Table 8
Percentages of AUs in Type of Overlap Categories by Diagnosis[1]

Type of Overlap	Diagnosis					
	Autism		Down Syndrome			
	M	SD	M	SD	t	p
Isolated	.23	.09	.13	.09	2.03	.06
Enclosing	.13	.04	.08	.04	2.74	.02
Interlinking	.10	.06	.13	.09	-.83	.42
Enclosed	.51	.10	.64	.08	-2.71	.02
Interrupted	.00	.01	.01	.01	-1.27	.22

[1]Calculated as a % of each child's total N of AUs.

In summary, based on the structural parameters of the behavior stream—the number and type of overlapping units—important differences between the children with autism and Down syndrome were revealed. Compared to the results of Wright (1967), that younger children behave in a more sequential manner, engage in one activity at a time, shift frequently from one activity to another, and persist in a given activity for a relatively short time, the findings from the present study suggest that the children with autism behave more immaturely than would be expected based on their age. An additional finding is that the structure of the AUs of the children with autism was more consistent with that of younger children, based on mental age comparisons with the children with

Down syndrome. The children with Down syndrome engaged in activities for a longer amount of time and more frequently engaged in more than one activity at a given time.

An unanswered question arising from these findings is the effect of communicative competence on the structure of the behavior stream. Findings that children with Down syndrome are more communicatively competent during social interaction than children at a similar level of syntactic development (Beeghly, Weiss-Perry, & Cicchetti, 1995) suggest a relative strength in pragmatic skills. In other words, it is thought that linguistic and pragmatic abilities can develop asynchronously. Interestingly, this asynchronicity is observed somewhat differently in autism (pragmatic skills lag behind syntactic skill development) and in Down syndrome (syntactic skill lags behind pragmatic skills). This reverse development in syntactic and pragmatic skill between children with autism and Down syndrome would be interesting to follow-up with another group of younger typically developing children and a group of children with mental retardation of unknown etiology. This information would help identify more of the features related to the dyad-in-context as the unit of analysis and document data of children's pragmatic language development.

The identification of the structural parameters of the behavior stream of both groups of children is important and new information that provides a unique difference apparently not attributable to mental age. Children with autism were observed to exhibit AUs of 50% shorter duration, 30% fewer number of overlapping units at a given time, and a different type of overlap as compared to the children with Down syndrome. Further

studies could examine the effect of communicative competence on the structure of the behavior stream.

Qualitative and Interactive Aspects of the Behavior Stream

The qualitative and interactive features of the behavior stream were characterized by several variables and are discussed in three main sections—setting and general AU characteristics, child-specific behavior, and other persons' behavior. Results from each category are discussed.

Setting and General AU Characteristics

Sociality of AU

One feature of the behavior stream that was examined was the *sociality* of the AU. Both the potential for social interaction and the complexity of social interaction were assessed. Subcategories were *complex social* (more than one person involved with child), *simple social* (one person involved with child), *potentially social* (people present but not involved with child), and *nonsocial* (no one present). Most of the AUs (81 or 68 percent) were rated as simple social. Only 8% of the AUs were nonsocial. There were no significant differences between boys with autism and boys with Down syndrome in terms of the sociality of the AU (see Table 9). These findings are consistent with Wright's (1967) results that the majority of childrens' activities involved other people.

Initiation of AU

Of the 1,182 AUs, 66 percent of the AUs of both groups were initiated by the child (see Table 10 for proportional scores). A *t* test of the proportional frequency scores

Table 9
Percentages of AU Time in Sociality Categories by Diagnosis [1]

Sociality	Autism		Down Syndrome			
	M	SD	M	SD	t	p
Complex Social	.36	.23	.38	.27	-.17	.87
Simple Social	.43	.18	.57	.28	-1.19	.26
Potentially Social	.16	.22	.03	.03	1.62	.15
Nonsocial	.06	.08	.03	.06	.69	.50

[1] Calculated as a % of each child's total AU time.

revealed no significant difference between the rate of child-initiated AUs ($t = .72$, $p = .48$), that is, children with autism were just as likely to initiate their AUs as the children with Down syndrome. A further question that can be asked is whether children with autism initiated less with children than with adults as suggested from the Hauck et al. (1995) findings that children with autism were less likely to initiate with children but equally likely to initiate with adults. No differences were found between the groups of children based on the other initiation codes including mom-, dad-, grandparent-, sibling-, or other child-initiated AUs; although there was a trend toward more mom-initiated units for children with Down syndrome ($p=.097$). Wright (1967) investigated initiation in terms of spontaneous, instigated, and pressured starts. Spontaneous starts were defined as the start of an episode that begins in the apparent absence of external instigation. Instigated starts, however, applies when the beginning of the episode is observed to be in response to some event. Pressured starts are applied to units that appear to begin in

response to pressure exerted upon the child. He found that age correlated negatively with spontaneous episode starts. The difference between behavior settings between older and younger children was thought to be the explanation. Further analysis of the data reported here could examine the same question regarding the nature of the initiation and would shed light on additional features of initiation.

Table 10
Percentages of AUs in Initiation Categories by Diagnosis[1]

Initiation	Autism		Down Syndrome			
	M	SD	M	SD	t	p
Child	.66	.10	.62	.12	.72	.48
Mom	.18	.10	.28	.12	-1.78	.10
Dad	.05	.05	.02	.03	1.61	.13
Sibling	.04	.05	.05	.04	-.44	.67
Grandparent	.03	.08	.00	.01	1.16	.28

[1]Calculated as a % of each child's total N of AUs.

Termination of AU

Of the 1,182 AUs, 71 percent of the AUs of both groups were terminated by the child. No significant differences were found between the rate of child-terminated AUs by diagnosis (t = 1.86, n.s.). Other comparisons of subcategories of terminations also indicated no differences (see Table 11.) As with initiations, Wright (1967) examined type of termination, such as spontaneous, environmental cessation, instigated, and pressured. Spontaneous units applied when the action of the unit appeared to be terminated by the

child, with no pressure from the environment. Environmental termination applied when the behavior of the unit was sustained by external forces and then brought to an end by the lack of these forces (e.g., child is riding bike and tire goes flat, then he stops riding bike). Instigated and pressured termination was defined similarly to instigated and pressured initiation. Wright (1967) found a high independence in children starting and stopping their activities, similar to the findings of this study.

Table 11
Percentages of AUs in Termination Categories by Diagnosis[1]

Termination	Autism M	Autism SD	Down Syndrome M	Down Syndrome SD	t	p
Child	.73	.09	.66	.08	1.86	.09
Mom	.16	.11	.26	.10	-1.92	.08
Dad	.05	.07	.01	.01	1.3	.23
Sibling	.07	.17	.03	.05	.66	.52
Grandparent	.02	.06	.01	.03	.51	.62

[1]Calculated as a % of each child's total N of AUs.

Initiation - Termination

Another feature of initiation and termination of AUs that can be calculated is the overall self-directedness of behavior, or, in other words, who began and who terminated the child's AUs. In general, of the 1,182 AUs, the most frequent pattern was the child both initiating and terminating about 52 percent (450) of his AUs in both groups (see Table 12). Other people initiated and the children terminated about 33 percent (385) of

the AUs. The child initiated and other people terminated about 25 percent (299), and other people initiated and terminated only 2 percent (22) of the AUs. With regard to the mean percentages of time spent in units falling in particular termination subcategories, Table 12 shows 60 percent of the time of children with autism was spent in child-initiated and terminated units as compared to 44 percent of the children with Down syndrome. Children with autism engaged in more self-directed AUs, but not significantly more. Overall, both groups of children showed the greatest number of child-initiated and terminated units and the largest percentage of time engaged in these units.

Child Behavior

Although all of the coding categories are related to the child, many categories were more child-specific than others. Such variables as the affect or mood of the child, the child's goal or intention in the AU, the mechanism or how the child accomplished his goal, and whether the child successfully accomplished his goal are described next.

Child's Affect

The level of the child's affect was rated on a 14-point interval scale (see coding manual in Appendix I for full description) from a score of -3.0, wildly unhappy, to 0, neutral, to a score of 3.0, wildly excited or happy. One other code, variable affect, was also applied for affect that fluctuated 2.0 points or more within the AU. Of the 1,182 AUs, the child's affect was rated mostly neutral to mildly happy in about 83 percent of the AUs (codes from 4 to 5). The mean percentages of the duration of affect by diagnosis are shown in Table 13. For statistical analysis, the codes were collapsed into four main

Table 12
Percentages of AU Time in Initiation - Termination Categories by Diagnosis[1]

Initiation - Termination	Autism		Down Syndrome			
	M	SD	M	SD	t	p
Child - Child	.60	.22	.44	.18	.12	.17
Child - Other Person	.25	.19	.28	.17	-.24	.74
Other Person - Child	.12	.05	.18	.15	-1.1	.29
Other Person - Other Person	.02	.04	.10	.10	-1.9	.08

[1]Calculated as a % of each child's total AU time.

groups from codes 1 through 2; 2.5 to 3.5; 4 to 5; and 5.5 to 7. No significant differences were found between groups based on the duration of a particular subcategory of affect during the behavior stream. This finding is not consistent with a frequently reported clinical impression that children with autism are lacking in affect as compared to other children. This finding is consistent with Yirmiya, Kasari, Sigman, and Mundy's (1989) observations that children with autism show affect as much as other children. The social appropriateness of affect was not analyzed in the present research, nor has it been reported in any other studies, and would be an interesting next analysis.

Table 13
Percentages of AU Time in Child's Affect Categories by Diagnosis[1]

Rating	Autism M	Autism SD	Down Syndrome M	Down Syndrome SD	t	p
Wildly to Moderately Unhappy	.01	.02	.01	.01	.44	.67
Mildly to Briefly Unhappy	.07	.07	.10	.10	-.76	.46
Neutral to Mildly Happy	.85	.12	.76	.13	1.5	.18
Moderately to Wildly Happy	.00	.00	.01	.02	-1.68	.14
Extremely Variable	.06	.08	.05	.09	.32	.75

[1]Calculated as a % of each child's total AU time.

Child's Intention in AU

An interesting focus of the behavior stream is the goal of behavior—a defining feature of the activity unit. During the unitization process, as described in Chapter IV, each AU had been given a label describing what the AU was about, what was happening, what the child was trying to do. A categorical system for the classification of children's goals was developed by a two-step process. First, a list of all the AU labels was created. Second, the list was sorted into categories that represented common themes. Thirteen types of goals were derived by this sorting method and they are listed in Table 14.

Of the 1,182 AUs, 440 units, or about 37%, categorized as *engaging in interaction with others* ranked as the most frequently occurring goal of an AU. The next most

common goal was 231 units, about 20%, labeled as *playing*. See Table 14 for the rank occurrence of goals based on the total 1,182 AUs.

Table 14
Percentage Rank Occurrence of Childrens' Goals [1]

Intention	Percentage of Frequency
To Engage in Interaction with Others	37.2
To Play	19.5
To Eat or Drink	7.1
To Examine Something	7.0
To Watch TV	6.4
To Maintain Self	5.3
To Ready the Environment	4.4
To Move Body	4.1
To Engage in Idiosyncratic Behavior	3.8
To Look for Something	1.8
To Express Affection	1.4
To Engage in Ritual	0.4
To Do Homework	0.3

[1]Percentage calculated based on total number of AUs for the total group of children.

When the *duration* of goals rather than the *frequency* of goals is considered, findings are somewhat different. Children spent the most time *playing*, followed closely by *watching TV*. A t-test analysis revealed that when *duration* of intention was compared

between groups, the children spent similar amounts of time participating in all but two types of activities: *readying the environment* and *eating and drinking* (see Table 15). Children with autism were observed to spend significantly more time readying their environment. Examples of this code included organizing their materials, cleaning up after themselves, and preparing food and drink. Children with Down syndrome were observed to spend significantly more time eating and drinking, about 50 percent more time, than the children with autism. Some children with Down syndrome were observed to get into conflict with their parents over food (generally the child wanted more food or would sneak food), while none of the children with autism were observed to do so.

The subcategory *to engage in interaction with others* was further analyzed with regard to *failure to respond to the initiation of another person*. Units that were initiated by another person and judged (a) to be intended to elicit a behavioral response from the child, and (b) to expect the child to respond were marked. T-test analysis of *failure to respond* between groups of children revealed that children with autism were significantly less likely to respond than children with Down syndrome ($t=4.2$, $p<.001$). Children with autism were about four times more likely to *fail to respond* as compared to the children with Down syndrome. This finding is consistent with Bauman and Courchesne's brain function research that the brains of individuals with autism appear to be less reliable and slower processors of information. Courchesne's (1994) inferences, based on his more

Table 15
Percentages of AU Time Goal Categories by Diagnosis[1]

Goal	Autism		Down Syndrome			
	M	SD	M	SD	t	p
To Engage in Interaction with Others	.09	.04	.14	.14	-1.0	.32
To Play	.35	.17	.29	.16	.73	.48
To Eat or Drink	.10	.06	.18	.04	-3.1	.01**
To Examine Something	.02	.02	.01	.01	.27	.79
To Watch TV	.25	.27	.29	.16	-.40	.70
To Maintain Self	.03	.04	.02	.02	1.0	.33
To Ready the Environment	.02	.02	.01	.01	2.2	.05*
To Move Body	.05	.10	.01	.02	1.2	.26
To Engage in Idiosyncratic Behavior	.06	.10	.02	.04	1.1	.29
To Look for Something	.01	.01	.03	.01	1.1	.28
To Express Affection	.01	.01	.00	.00	.93	.37
To Engage in Ritual	.00	.00	.00	.00	-.16	.87
To Do Homework	.00	.00	.04	.08	-1.4	.20

[1]Calculated as a % of each child's total AU time.
*$p<.01$
**$p<.001$

molecular-level analyses of attention impairments using behavioral and neurophysiological studies and on some molar-level behaviors, is relevant. He and his colleagues developed a shift of attention task that required a rapid shift in attention from a visual to auditory stimulus. His findings revealed a deficit in the ability of people with

autism to fully disengage attention and reengage attention. Shifting attention for people with autism was described as "more variable, inaccurate, poorly timed, and effortful" (p.127).

Findings regarding two types of AUs, *attracting attention to self* and *interacting with others,* are important nonsignificant findings. Children with autism spent similar amounts of time as the children with Down syndrome engaging in these two types of activities. An interesting follow-up question would be the form of these two goals. For example, one child with autism was observed to turn his TV off and on repeatedly and look toward his grandmother each time as if to obtain her attention and initiate interaction. While children with Down syndrome appeared to engage in more "direct" methods to gain attention, such as calling to mom, then smiling or showing off. While children in both groups spent similar amounts of time interacting with others, the duration of interaction was different and is discussed later in the chapter.

Another important follow-up to the present study is an analysis of the types of play of the children. Children with autism and Down syndrome both showed examples of symbolic play. For example, a child with autism engaged in pretend play involving taking his toy car to the mechanic. The quality of his play with regards to his age would be interesting to pursue and then compare to the play of the children with Down syndrome. More documentation regarding the development of symbolic skills over time is needed in the area of autism. In order to shed more light on the qualitative differences of the forms of several types of behavior as detailed in the goals of AUs, more in-depth analysis is necessary.

Difficulty Judging Child's Goal in AU

The coder's difficulty of judging the child's goal in the AU was assessed. It was thought that, in addition to the initiation-termination feature of the behavior stream as a measure reflecting the self-directedness of behavior, the ease in judging or interpreting the behavior of the child would reflect clarity of intention, another sample of self-directedness. In addition, while behavioral goals are a potentially important area of study, judgement of these goals had been problematic in previous work (Wright, 1967) and the present study provided an opportunity to investigate this interesting methodological question. The coder was asked to rate, on a scale of 1 (not at all difficult) to a scale of 4 (extremely difficult), the ease in judging the child's intention. Of the 1,182 AUs, about 84 percent (991) were coded as 1 or 2. The other 16 percent (190) were rated as being moderately to extremely difficult to judge. T-test analysis revealed no significant differences between the children with autism and those with Down syndrome based on difficulty judging intention of AU (see Table 16). Thus, the clarity in the intentions of the children was not related to diagnosis. An important consideration in this code is that the appropriateness of the intention was not assessed, and while intentions may have been clear to judge in general, their relative adaptability or social appropriateness is still a question.

Mechanisms Used to Accomplish Goals

Another feature of the AUs was the mechanisms children used to accomplish their goals. Table 17 shows the frequency percentage of methods used for goal

Table 16
Percentages of AUs in Difficulty with Rating Child's Goal Categories by Diagnosis[1]

	Autism		Down Syndrome			
Level of Difficulty	**M**	**SD**	**M**	**SD**	**t**	**p**
Not Difficult	.79	.11	.82	.10	-.50	.63
Somewhat Difficult	.05	.03	.06	.04	-.57	.58
Moderately Difficult	.10	.06	.05	.05	1.85	.09
Extremely Difficult	.06	.05	.07	.08	-.44	.66

[1]Calculated as a % of each child's total N of AUs.

accomplishment. Because children often used more than one mechanism per AU, the total number of mechanisms was used as the divisor instead of the total number of AUs. Statistical analysis of the methods used by diagnosis indicated no significant difference in the rate of verbal, watching, or vocalization. Differences in the rate of gestures and physical mechanisms were identified. Children with Down syndrome were more likely to use gestures ($t=-3.8$, $p<.01$). Gestures included showing, pointing, waving, nodding, and shrugging. Children with autism, on the other hand, were more likely to use physical methods ($t=4.1$, $p<.001$). Physical methods included physical contact such as touching someone's shoulder or grabbing someone hand, physical assistance, such as leading mom to the swing, gross motor activities such as walking and running, and fine motor activities

such as moving fingers to play a keyboard. After adjustment using Bonferroni method (.05/5=.01), the differences between the rates of gesture and physical strategies remained significant. The use of more physical strategies and less gestures by the children with autism highlights their language problems and is consistent with previous research (Wetherby, 1986).

Table 17
Percentages of AUs in Mechanisms Used Categories by Diagnosis[1]

	Autism		Down Syndrome			
Mechanism	**M**	**SD**	**M**	**SD**	**t**	**p**
Verbal	.24	.21	.37	.08	-1.7	.13
Gesture	.04	.05	.14	.06	-3.8	.002**
Physical	.51	.12	.32	.06	4.1	.001***
Watching	.11	.05	.09	.04	.67	.51
Self-Injury	.00	.00	.01	.00	1.0	.35
Vocalization	.09	.08	.07	.02	.87	.41

[1]Calculated as a % of each child's total N of mechanisms used.
**p <.01
*** p < .001

Outcome of Goal Achievement

Another feature of the behavior stream that focused on child behavior was the outcome of the AU. The rate at which children were observed to accomplished their goals was examined. Of the 1,182 AUs, 898 or about 76 percent were judged as ending in successful goal completion. Successful goal completion was defined as the child meeting

his goal in the AU. Only 144 or about 12 percent of AU were judged as unsuccessful or incomplete. About 140 or 12 percent of AUs were judged to be unclear as to whether the child completed his goal because of an ambiguous outcome. When diagnosis was considered with ability to complete goals (see Table 18), children with autism and children with Down syndrome were rated similarly with regard to failing to accomplish their goals. There was a trend ($p=.07$) for more children with Down syndrome to complete their goals. Children with autism were rated to have significantly more ambiguous goal completion as compared to the children with Down syndrome ($p=.016$). This finding remains significant after Bonferroni adjustment ($.05/3=.016$). A more detailed follow-up to this finding might suggest the different forms of behavior that children with autism use in their AUs. It would be interesting to ask their parents whether their children accomplished their goals, as parents appear to be good interpreters of their child's behavior.

Previous research has examined goal completion. Wright (1967) found a negative correlation between age and percent of incomplete activities. Typically developing younger children stopped short of the goal more frequently than did older children. But in the majority of units, all children finished what they started. Another examination regarding the content of the AUs could determine whether children with autism stopped short of completing their goals for various reasons or encountered a barrier which they could not develop a strategy to overcome. Using ecological methods, Scott (1997) examined the types of problems encountered by typically developing children and the corresponding methods used to solve problems. When there was clear evidence that a

child was presented with a barrier to overcome or some tension to be reduced, children were observed to be the most frequent problem solver themselves, and quite competent and creative in their attempts to problem solve. An interesting finding in Scott's study is that the most frequently encountered problem was social in nature and the most frequently used method to solve the problem was verbal. Given the impairment in social and verbal abilities in autism, it would be quite interesting to re-analyze this data using Scott's techniques.

Table 18
Percentages of AUs in Goal Completion Categories by Diagnosis[1]

	Autism		Down Syndrome			
Was Goal Completed?	**M**	**SD**	**M**	**SD**	**t**	**p**
No	.10	.04	.16	.06	-1.2	.25
Yes	.75	.09	.80	.08	-2.0	.07
Unclear	.15	.09	.04	.04	2.7	.016*

[1]Calculated as a % of each child's total N of AUs.
p<=.016

Intensity of Effort of Child

The final child-related category examined the effort put forth by the child during the unit. A 5-point Likert scale was used to judge the intensity level within the unit. A score ranging from 1, small amount of energy and a low level of effort, to a score of 5, a considerable amount of energy and effort, was applied. Another subcategory *variable* was used for rating units in which the child showed very mixed levels of intensity, ranging at least 2-points. A final category *cannot judge* was used to rate ambiguous units.

Table 19 shows the mean percentages of intensity by diagnosis. No significant differences were observed between groups of children based on the level of intensity of their behavior. The children with autism, however, spent 19 percent of AU time exhibiting variable level of intensity as compared to only 6 percent of the AU time of the children with Down syndrome; no significant difference was observed.

Table 19
Percentages of AU Time in Intensity of Effort Categories by Diagnosis[1]

Level of Intensity	Autism M	Autism SD	Down Syndrome M	Down Syndrome SD	t	p
None to Small	.02	.01	.04	.07	-.91	.39
Small to Medium	.10	.22	.02	.02	1.1	.30
Medium	.14	.13	.14	.14	-.07	.95
Medium to Considerable	.21	.12	.32	.24	-1.2	.27
Considerable	.51	.22	.49	.19	.19	.85
Variable	.19	.22	.06	.06	1.7	.11
Cannot Judge	.00	.01	.00	00	2.2	.06

[1]Calculated as a % of each child's total AU time.

Other People's Behavior

Attributes of the behavior stream that reflected the behavior of other people were examined in terms of (a) who was involved, (b) their affect, (c) mechanisms used with the child, (d) intensity of their effort, and (e) duration of their involvement.

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Other Persons Involved

Mothers were the primary people involved with the children, and they were involved in over 50 percent of the AUs (606). Fathers were involved in about 8 percent (91) and grandparents in about 8 percent (95) of the AUs. Siblings were involved in about 7 percent (80), another child in about 3 percent (33), co-equals in about 2 percent (23), and another adult in about .5% (4) of the AUs. Table 20 shows the relative percentage rates of AUs involving a particular person. There were no significant

Table 20
Percentages of AUs in Type of Person Involved Categories by Diagnosis[1]

	Autism		Down Syndrome			
Person	**M**	**SD**	**M**	**SD**	**t**	**p**
No One	.16	.15	.14	.10	.39	.70
Mother	.43	.25	.64	.22	-1.8	.10
Father	.12	.14	.04	.06	1.6	.14
Sibling	.08	.09	.08	.09	.01	.99
Other Child	.05	.13	.03	.05	.34	.73
Coequal	.02	.02	.02	.04	-.39	.70
Grandparent	.09	.24	.00	.00	1.0	.35
Other Adult	.01	.01	.01	.01	.00	.99

[1]Calculated as a % of each child's total AU time.

differences between diagnostic groups in terms of the type of people involved in AUs. Wright (1967) found mothers exceeded fathers by a margin of 7 to 1 with regards to involvement in his study, more than noted in this data.

Primary Person's Affect

The same scale as that used for child affect was used to rate the primary person's affect. In general, almost three-quarters of the affect rated fell within the overall neutral range. Over half of the interactions involving another person were rated as including a neutral partner for both groups of children. No partners exhibited extremely unhappy behavior. When the affect of the primary person was compared between the groups of children, no significant differences were observed (see Table 21). The percentages do not total 100% because partners were not involved in all AUs.

Table 21
Percentages of AUs in Primary Person's Affect Categories by Diagnosis[1]

	Autism		Down Syndrome			
Level of Affect	**M**	**SD**	**M**	**SD**	**t**	**p**
Moderately Unhappy	.01	.01	.01	.01	.06	.95
Mildly Unhappy	.13	.09	.12	.05	.23	.82
Neutral but Kind	.66	.19	.71	.14	-.53	.60
Extremely Happy	.00	.00	.01	.02	-1.68	.12
Mixed	.00	.00	.01	.01	-1.00	.33

[1]Calculated as a % of each child's total N of AUs.

Mechanisms Used by Other Persons

Because partners often used more than one mechanism to interact with a child during an AU, the proportional score was determined by using the total number of partner mechanisms as the divisor. In general, partners interacted with children primarily through verbal means. The partners of children with autism and the partners of children with Down syndrome used verbal means at a rate of 63 and 75 percent, respectively. This difference was significant following Bonferroni adjustment ($t=-2.8$, $p=.01$). Gestures were used similarly by partners of both groups of children at a rate of about 7 percent. Physical mechanisms, however, were used at a rate of 18 percent by partners of children with Down syndrome as compared to 32 percent by partners of children with autism. A significant difference was observed ($t=3.5$, $p=.003$) after Bonferroni correction indicated alpha be set at $p < .017$ (see Table 22). This finding suggests that partners of children with autism relied on more elemental and direct means to communicate with the children and highlights the language problems observed in children with autism. It is unclear whether partners had adapted to the child due to perceived problems with communication or as a way to "match" their child's communication level given the finding that children with autism used more physical strategies and less verbal means in their AUs as compared to the children with Down syndrome. It would be interesting to track children as soon as they are diagnosed in order to determine whether parents start using verbal mechanisms at a similar rate when children are very young and then over time adapt the frequency of verbal output.

Table 22
Percentages of AUs in Partner's Mechanism Type Categories by Diagnosis[1]

	Autism		Down Syndrome			
Mechanism	**M**	**SD**	**M**	**SD**	**t**	**p**
Verbal	.63	.10	.75	.08	-2.8	.01**
Gesture	.07	.04	.08	.03	-.43	.68
Physical	.31	.09	.17	.06	3.5	.003**

[1]Calculated as a % of each child's total N of AUs.
**p<.01

Intensity of Effort of Other Persons

Using the same scale as described previously for child effort, the coder rated the amount of effort the partner expended while interacting with the child. Of the 80 percent AUs (938) which featured a partner, about 70 percent of people within these units were characterized as exhibiting a medium to high level of intensity (see Table 23).There were no significant differences between diagnostic groups. The percentages did not total 100 because partners were not included in all AUs.

Duration of Other's Involvement

Coders estimated the amount of time the partner was involved with the child from low (less than 20 percent of time) to high (80 percent to 100 percent of time) (see the coding manual for the category and codes in Appendix I). In general, other people were rated as being involved throughout most of the AU (80-100 percent of the time) in about 62 percent of the units. Table 24 shows the duration of AU time by diagnosis. All

Table 23
Percentages of AUs in Level of Partner Intensity Categories by Diagnosis[1]

	Autism		Down Syndrome			
Level of Intensity	**M**	**SD**	**M**	**SD**	**t**	**p**
Small	.01	.02	.01	.01	.63	.57
Small to Medium	.04	.05	.05	.08	-.46	.66
Medium	.28	.09	.22	.11	1.16	.27
Medium to High	.28	.10	.29	.11	-.11	.91
High	.15	.14	.20	.15	-.80	.43

[1]Calculated as a % of each child's total N of AUs.

statistical comparisons were nonsignificant with the exception of *high* duration. Partners of a child with Down syndrome were rated as engaging in *high* duration 70 percent of AU time as compared to only 37 percent of AU time when interacting with a child with autism. This finding was significant following Bonferroni adjustment of alpha (.05/5=.01). Possible explanations for this finding are that (a) partners react with less duration because of the effort required to engage in ongoing interaction with the child with autism or (b) the child's impairment in reciprocity leads to less time with partners. The direction of correlation may be explained with data obtained from very young children. Observation of toddler interactions with parents using methods from ecological psychology may clarify whether the duration of interaction put forth by parents is different from the start or whether the lack of reciprocity exhibited by the child eventually leads to less duration of interaction with others.

Table 24
Percentages of AU Time in Level of Duration Categories by Diagnosis[1]

	Autism		Down Syndrome			
Duration	**M**	**SD**	**M**	**SD**	**t**	**p**
Low (less 20%)	.24	.13	.10	.14	2.09	.06
Moderately Low (21-40%)	.09	.10	.03	.04	1.59	.06
Moderate (41-60%)	.05	.06	.02	.02	1.46	.17
Moderately High (61-80%)	.06	.07	.10	.13	-.83	.42
High (81-100%)	.37	.16	.70	.17	-4.04	.00***

[1]Calculated as a % of each child's total AU time.
**p<.001

Summary and Conclusions

Chapter 6

Two weaknesses of previous research—restriction of most designs to experimental contexts and bias in research participants—have posed special obstacles in developing a more in-depth understanding of the qualitative features of social and communicative impairment in autism. First, most studies have been confined to easily quantifiable variables (Howlin, 1986) missing the qualitative aspects of behavior. Second, studies examining social-cognitive development have limited generalizability because social knowledge may become confused with actual social use (Volkmar & Klin, 1993) and, as verbal mental age increases, the chance of passing social-cognitive tasks increases (Bowler, 1992; Eisenmajer & Prior , 1991; Ozonoff et al. 1991). Third, because most experimental studies have been done with individuals with autism who can respond to the verbal requirements of the tasks, data from participants who are low verbal but also more representative of autism are lacking. In order to counteract some of these weaknesses, alternative methodological paradigms must be applied to understand the quality of the social impairment in autism.

While important research studies based on behavior in the natural habitat are available, the methodological restrictions of these studies must be recognized. The strength of available naturalistic research is that the research is conducted independent of the investigator's influence. However, the nature of data collected represent data characterized as behavior tesserae (Barker, 1963). Behavior tesserae are the selected fragments of behavior used for a particular investigation and are the result of

interruptions in the natural behavior stream. Such interruptions include a predetermined time-period or certain number of behavioral occurrences to define the behavior stream. The social cognition studies in autism are examples of behavior tesserae, when the investigator asks the child to perform in some way using experiments, tests, questionnaires, and interviews (Barker, 1963). Further, naturalistic studies that assess behavior every 15-seconds for five minutes break up the naturally-occurring stream of behavior. The research reported here is the first study to assess the intrinsic structure of the behavior stream of children with autism in the natural habitat.

Summary of the Study

Ecological methods of narrative recording in the natural environment were applied to study the *stream of behavior* of individuals of two groups of individuals (Barker, 1963). Boys with autism and boys with Down syndrome who were between the ages of 6 and 10 years and of comparable adaptive behavior and cognitive levels served as participants.

Chronolog records as described by Scott (1980) were collected via a stenomask (Schoggen, 1964). Both the duration and frequency of behaviors were recorded within the stream of behavior. Chronolog data represent ongoing behavior at a larger molar level. The behavior of the people around the child and the ongoing events were described and provided in the chronolog descriptions as context. In the margin of the chronolog, time notations were made. Each child was observed approximately two hours, resulting in about 50 pages of chronolog data per setting observation.

Each chronolog was analyzed by a two-step process. First, the stream of behavior as represented by the chronolog was unitized into its naturally occurring units called

Activity Units (AUs). The AU was based on a naturally occurring chunk of behavior from the perspective of the child and occurred along a constant psychological direction (Scott, 1980). The AUs had a clear beginning and end point. When the actor engaged in a distinct activity, a new unit was marked. Reliability of unitization ranged from the high .80s to .90s. Subsequent to unitization, each AU was given a label that represented the child's goal. A 23 category code system was used to analyze the parameters of the AUs. Categories emerged from the data themselves as well as from the literature. The reliability of the most of the codes fell within the .80s to .90s.

Conclusions

The major findings of the structure of the behavior stream of the children with autism were that children with autism engaged in shorter AUs and fewer overlapping AUs than children with Down syndrome. Their AUs were 50 percent shorter as compared to the children with Down syndrome. Further, the children with autism engaged in more enclosed AUs, a finding that suggests the behavior of younger children (Wright, 1967). Wright's research found that younger children behaved in a more sequential manner, engaged in one activity at a time, shifted frequently from one activity to another, and persisted in a given activity for a relatively short time. The findings from the present study suggest that the children with autism behave more immaturely than would be expected based on their mental age.

Further findings with regard to the AUs of the children and the mechanisms used by the children to accomplish goals indicate that for the most part, both groups of children engaged in similar types of activities at home. Only two types of AUs were

found to be significantly different with regard to their duration. Children with Down syndrome spent more time *eating and drinking*. Children with autism spent more time *readying their environment*. A subcategory analysis of *failing to respond* was conducted and revealed that children with autism were four times more likely than children with Down syndrome to fail to respond to someone who was trying to elicit a response from the child. This finding is consistent with Mundy et al.'s (1990) suggestions that the responsivity of children with autism may depend on the effort required to process social stimuli which incorporates joint attention. A second related explanation may also be described as an impairment in shifting of attention. Courchesne (1994) suggests that problems with disengaging and reengaging attention reduce "ability to continuously follow the rapidly and unpredictably changing events that direct and compose reciprocal social interactions" (p.131).

Another interesting finding was that children with Down syndrome used more gestures, while children with autism used more physical strategies in their behavior. Although the groups were of similar adaptive communicative levels, the use of more physical strategies by the children with autism highlights their language problems. In addition, the finding that partners of children with autism used more physical mechanisms and less verbal means when interacting with the child suggests that language problems might have been perceived by other people and adjustments were made in the way they interacted with the children. Wetherby's (1986) findings that children with autism displayed more interactions that led to an environmental consequences rather than a social consequence was not studied but would be interesting to pursue.

When the characteristics of the environment of the children were examined, findings revealed that even though the sociality or the opportunity for social interaction was the same for both groups of children, partners of children with autism were more likely to spend less time with the children as compared to partners of children with Down syndrome. It is unclear whether the problems children have with sustaining social interactions in a reciprocal manner (Lord, 1984; Smith, 1990; Walters et al. 1990) explain this finding or whether the effort required to interact with these children was a factor.

Important nonsignificant findings also emerged. No difference in affect was found between the groups of children, in contrast to clinical lore which suggests that children with autism show less affect as compared to other children. Another important nonsignificant finding related to two types of AUs—*attracting attention* to self and *interacting with* others. Children with autism spent as much time as the children with Down syndrome performing these two types of activities. A question regarding the form of these behaviors, asking how these activities were performed, would be interesting to pursue further. A final nonsignificant finding related to outcome of activities. Both groups of children were just as likely to accomplish their goals.

A question of whether narrative recordings of molar level behavioral descriptions allow for the identification of differences between children with autism and children with Down syndrome was answered. Chronolog analysis comprised of molar level behavioral descriptions did allow for the identification of differences between the groups of children. Many similarities, however, were also observed between the groups of children. It is unclear whether the similarities between the groups of children were more likely

related to the category codes posed for this study rather than the level of behavior described. Throughout the discussion, however, many of the similarities reported were found to be consistent with previous research.

In summary, researchers of social and language development recognize the need to understand children in their natural environment as they interact with other people. The utility of ecological methods was tested and found to reveal new and important information regarding the behavior of children with autism in their own environments. Further information regarding not only the delay that is noted in other disabilities like mental retardation, but also the process of atypical development was revealed. Because of the neurological basis of autism, relevant theories must take into account both the delay and difference in development noted in autism. Data documenting the development of skills over time, however, is lacking.

The tacit knowledge of children with autism as an actor in the social world can be revealed by ecological methods. Further analysis of these data could address the social-knowledge-in-action-in-context of children with autism. Examination of the functional and pragmatic use of language within a social context (Stone & Caro-Martinez, 1990) would be an important follow-up to these data, such as clarifying the use of protodeclarative gestures, joint attention behaviors, and the multiple purposes of unconventional verbal behavior (Prizant, 1995).

Next Research Steps

Several further research studies are suggested by the present research. Some of these include:

1. Compare higher functioning children with autism to these children and typically developing children;

2. Compare these data to more recent data based on typically developing children of a younger age to determine the developmental level of children with autism using results from ecological methods (e.g., based on number of AUs, type of overlap, number of overlapping AUs, etc.);

3. Compare children with autism in different behavior settings using ecological methods (e.g., school setting);

4. Analyze the *form or quality* of behavior with regard to several variables (e.g. interacting with others, attracting attention to self);

5. Document the quality of play and determine the developmental level of play observed in children with autism;

6. Apply the dyad-in-context as the unit of analysis and examine the unconventional verbal behavior observed in children with autism;

7. Conduct a longitudinal study with these same children using the same methodology;

8. Determine whether naive readers (people who do not know the diagnosis of the child) can accurately predict diagnosis based on molar level behavioral descriptions reported in the chronolog;

9. Compare molar level behavioral descriptions to data of other levels in order to capture all the behavior a child emits; and

10. Compare in further detail individual child differences within the groups.

Implications for Practice

The findings from this study can be incorporated into current diagnostic protocols in autism. Given that many researchers acknowledge social impairment as the core feature of the diagnosis of autism, and that there is a corresponding dearth of adequate clinical social development assessment measures, these data can be used to develop a framework of social development. For example, descriptions of play, joint attention skills, and imitation skills provided in the chronolog data can be incorporated into the development of a social assessment measure. Some of the qualitative and quantitative differences in development are captured by ecological methods.

Another implication related to intervention. These findings suggest that parents and teachers need to be encouraged to treat children with autism using different strategies. For example, the use of more physical strategies and other mechanisms to interact with the child with autism, rather than verbal means, is suggested because of their receptive and expressive language difficulties. In addition, the children were observed to perform better in a sequential manner for shorter period of time. This finding suggests that the children may benefit from activities that are peformed sequentially with less requirements of shifting attention from one task to another task simultaneously.

A further implication is that ecological methods can be applied to study the outcome of interventions. Recent attention has been given to intervention methods of discrete trial teaching (Lovaas, 1981; Maurice 1996), and McEachin, Smith, and Lovaas, (1993) have claimed to treat children with autism by these methods so that they are indistinguishable from their typically developing peers. Ecological methods could

document the merit of these claims and be used to evaluate other intervention programs. It would be interesting, for example, to determine whether the length of AUs, number of overlapping AUs, and mechanisms used to accomplish goals, differ between children with autism who receive intensive discrete trial teaching as compared to those who do not.

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Appendix A: ***DSM-IV Criteria for Autistic Disorder***

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):

(1) qualitative impairment in social interaction, as manifested by at least two of the following:

(a) marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
(b) failure to develop peer relationships appropriate to developmental level
(c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)

(2) qualitative impairments in communication as manifested by at least one of the following:

(a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
(b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
(c) stereotyped and repetitive use of language or idiosyncratic language
(d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

(3) restricted, repetitive, and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:

(a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
(b) apparently inflexible adherence to specific, nonfunctional routines or rituals
(c) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
(d) persistent preoccupation with parts of objects

B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.

C. The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder.

Appendix B: ***DSM-IV Criteria for Mental Retardation***

A. Significantly subaverage intellectual functioning: an IQ of approximately 70 or below on an individually administered IQ test (for infants, a clinical judgment of significantly subaverage intellectual functioning).

B. Concurrent deficits or impairments in present adaptive functioning (i e, the person's effectiveness in meeting the standards expected for his or her age by his or her cultural groups) in at least two of the following areas: communication, self-care, home living, social/interpersonal skills, use of community resources, self-direction, functional academic skills, work, leisure, health, and safety.

C. The onset is before age 18 years.

Code based on degree of severity reflecting level of intellectual impairment:

Mild Mental Retardation	IQ level 50-55 to approximately 70
Moderate Mental Retardation	IQ Level 35-40 to 50-55
Severe Mental Retardation:	IQ Level 20-25 to 35-40
Profound Mental Retardation:	IQ Level below 20 or 25

Mental Retardation, Severity Unspecified: when there is strong presumption of Mental Retardation but the person's intelligence is untestable by standard tests

Appendix C: Parent and Teacher Letters

Dear Parents,

Your are invited to participate in a research study. The purpose of this study is to gain information about the social behavior of children with autism and children in moderate/severe educational programs, in their natural environments. I plan on comparing observations of children in moderate/severe programs to observations of children with autism. All of the children will be boys between the ages of 6 and 10 years.

Participation in this study would involve completing a written survey and an interview with me or the research assistant that focusses on your child's social, communication, and daily living skills, and family information. Also, I would ask to observe you and your family at home before, during, and after dinner for a total of 2 to 3 hours. It is anticipated that you would participate in 2 or 3 sessions, depending on how well your family adapts to my presence in your home. The amount of time that will be required for the home observations will not exceed 6 hours. Also, I would like to observe half of the children participating in this study at school for approximately two hours during unstructured and structured activities. All families participating in this study will receive $25.00.

If you are willing to participate in this study or if you have any questions about the study or the procedures, please call me collect at 314-544-2152 or the research assistant, Shannon Lazar, at 317-342-8278. You could also write me at the address below. Thank you very much for your time.

Sincerely,

Lisa Ruble, MS
Doctoral Candidate Indiana University
3821 Courtois St.
St. Louis, MO 63123

Dear Teacher,

I am a graduate student who has been hired by Lisa Ruble to assist her in recruiting subjects and collecting data for her study. Thank you for agreeing to help locate children who might quality for participation in the study.

Descriptions of the social behavior of children with autism will be collected and compared to that of children with Down syndrome. This research is unique because detailed descriptions of social behavior will be collected in the natural environment of the children, at home and at school.

To provide doctoral students with research experience, this research has been funded by the U.S. Department of Education. Consequently, funds are available to reimburse parents for their participation.

We ask that you forward the letter to parents and informed consent statement that I have sent you to any parents who might be willing to participate in the research. Parents of children with Down syndrome are needed. Parents who have children who are male and between the ages of 6 and 10 should be selected to receive the letter. Parents who wish to participate can give you permission to give us their names or they may contact us directly. This will ensure the confidentiality of all possible participants.

Thanks in advance for your support of this research. Please contact the student researcher, Lisa Ruble at 314-544-2152, the research assistant, Shannon Lazar, at 317-342-8278, or the faculty sponsor, Dr. Myrtle Scott at 812-856-8323.

Sincerely,

Shannon Lazar

Appendix D IUB INFORMED CONSENT STATEMENT

A Comparative Study of Social Development in Autism: An Ecological Approach

You are invited to participate in a research study. The purpose of this study is to gain information about the social behaviors of children with autism in their natural environment.

INFORMATION

1. As part of this study, I plan on gathering information about your child by observing him or her at your home during a structured and unstructured activity.

As a **parent** you would complete two tasks:

(a) an **audiotaped interview** in your home that focuses on your child's social behaviors and basic information that describes your family such as the number of children you have, their ages, and what activities you do together as a family.

(b) the **Vineland Adaptive Behavior Scale**. This is a common measure that is used frequently and assesses your child's communication, social, and daily living skills.

And **you and your family** will be observed at home:

(c) I will come to your home and describe the purpose of the study. I will then show you the instrument called a stenomask that will be used to help me record your child's behavior. The stenomask is a recording device that covers the lower half of the face, quieting my comments and allowing me to unobtrusively record all ongoing events in the environment onto an audiotape. I will demonstrate how the stenomask works and let your child and other family members look at the stenomask. After this orientation, I will conduct a practice observation and show you what a record of behavior looks like. The final step, the observation, will occur before dinner, during dinner, and after dinner for a total of about 2 to 3 hours.

2. The amount of time that will be required from you and your family will be approximately 2-3 hours. It is anticipated that you will participate in 1 or 2 sessions, depending on how well your family adapts to my presence in your home. The maximum time you will participate will not exceed 6 hours. I anticipate that I will spend no more than 4 hours with you and your family while conducting the observations and informal interviews.

3. There will be 8 children with autism and 8 children with mental retardation and their families participating in this study.

4. Your interviews and observations will be audiotaped. The tapes will be used for research purposes only. Only the researcher will have access to the tapes. If you withdraw from the study, your tapes will be destroyed. At the end of the study all tapes will be destroyed.

RISKS

It is possible that you as the parent or you as another family member may feel uncomfortable with my presence in your home during family activities. But this is expected to be minimal. You are free to not answer a question or to withdraw from this study at anytime.

_____

subject's initials

BENEFITS and COMPENSATION
This study will help researchers, educators, and parents understand how the social behavior of children with autism develops as compared to other children. It is hoped that this will help us develop better ways to intervene and teach children with autism how to be more socially competent.

CONFIDENTIALITY
The information in the audiotapes will be kept confidential. Data will be stored securely and will be made available only to persons conducting the study unless you specifically give permission in writing to do otherwise. No reference will be made in oral or written reports which could link you to the study.

CONTACT
If you have questions at any time about the study or the procedures, or you experience adverse effects as a result of participating in this study, you may contact the researcher, Lisa Ruble, at Wilbur Wright Building, School of Education, Indiana University, Bloomington, IN 47405. If you have questions about your rights as a subject, contact the office for the Human Subjects Committee, Bryan Hall 10, Indiana University, Bloomington, IN 47405, 812/855-3967.

PARTICIPATION
Your participation in this study is voluntary; you may decline to participate without penalty and without loss of benefits. If you decide to participate, you may withdraw from the study at any time without penalty. If you withdraw from the study prior to its completion your data will be destroyed.

CONSENT
I have read and understand the above information. I have received a copy of this form. I agree to participate in this study.

Child's name_____ Date_____

Parent(s) signature_____ Date_____

Investigator's signature_____ Date_____

Appendix E: Hints to observers when adapting the family.

Interview parents about what occurs before, during, and after dinner. Start observation before dinner. Look for naturally occurring ending markers to know when to stop observing.

When introducing yourself to the family, tell them that we are studying naturally-occurring behavior of children with autism in natural settings to see what they do. Tell them that we won't be interrupting or participating, so don't make us dinner.

Tell the children you are working, keep answering all questions until they stop asking questions during orientation.

When working, ignore the children, don't reinforce interaction (look like cow chewing cud). Sibling may try to interact with you, look disinterested and bored. You can tell that family is adapted when they have tuned you out. When kids go away and don't look at you. You will see more behaviors, wider range of behaviors, more uneven behaviors when "adaptation" has occurred (eg, head scratching, yawning). Don't look away if someone looks at you, look at their hairline, look over at the wall, etc.

Hints to "blend in" at home and at school:

Try to see what is going on in the environment
Standing is usually best, see if there is a place to sit away from activity, if sitting. If standing, stand near the wall, next to upright furniture to enhance blending in.

Once family seems "adapted" try taking a step or two away from your anchor point. Watch there reaction. This helps tell you how "adapted" they are. Go back to your anchor.

When you know family is adapted, go back for 2nd visit. They'll probably asks 2 - 3 question in the beginning. In about 20 minutes they should be adapted.

Appendix F: Rules of Recording Behaviors
(Adapted from Wright, 1967)

1. Focus upon the behavior and the situation of the child.

   a. It is useful to report an action of someone other than the child, or a circumstance that apparently does not exist for him, if the action or the circumstance is one that would ordinarily be expected to register upon and somehow make a difference to the child.

   b. It is useful to report an action of someone other than the child or a circumstance that apparently does not exist for him, if the action or the circumstance is one that leads up to a change in the situation of the child.

2. Observe and report as fully as possible the situation of the child.

3. Never make interpretations carry the burden of description.

   In the written revisions, all interpretative comments should be bracketed.

4. Give the "how" of everything the child does.

5. Give the "how" of everything done by any person who interacts with the child.

6. Report in order, in the final writing, all of the main steps through the course of every action by the child.

7. Wherever possible, state descriptions of behavior positively, that is, say what the child did, not what the child did not do.

8. Describe in some detail the scene as it is when each behavior setting is entered.

9. Put no more than one unit of molar behavior in one sentence.

10. Put in one sentence no more than one thing done by a person in the situation of the child.

11. Do not report observation in terms of time intervals.

Appendix G: Family Context Sheet

Name:

Address:

Phone:

Child:

DOB:

1. What is a typical day like during the week?

During the weekend?

2. How many typical days do you have during the week?

3. How many are in your family?

4. Who lives in your house?

Name Age

5. Who works?

6. What hours?

7. Who is in charge of primary care throughout the day?

8. What things do you do together as a family? When? How often?

9. How much do you go out?

10. Where do you go? How long do you stay?

11. What are your family interests?

12. What are your child's interests and likes?

13. What other family or friends do you have contact with? How often?

14. Any major changes in the last 6 months?

15. Who all will be here for dinner when I come and observe?

Appendix H: Chronolog Pilot Data
Name: Richie
Age: 6 years, 11 months old
Diagnosis: Autism
Grade: Kindergarten
School: Smith Elementary
Time of Observation: Approximately 5:30 to 7:30
Observers Name: LR
Place: Home
Settings: Grandparent's Kitchen
Grandparent's Living Room and Dining Room
Upstairs Living Room
Upstairs Bedroom
Participants: Mom = Richie's mom
Dad = Mom's fiance'
Bobby = Richie's 8-year-old brother
Grandma = Richie's maternal grandma
Grandpa = Richie's maternal grandpa

[This is an excerpt from dinner time.]

Eating Dinner[19]

Richie continues to eat, not responding in any way to mom's comment to dad.

31'26" Dad begins to talk to mom about dad hurting his ankle.

Richie continues to eat.

[OC: Richie holds his fork in an unusual way, in that he has his hand over his fork similar to what you see younger kids do.]

Mom asks Bobby how his day was at school.

Dad immediately asks Bobby whether he has homework.

Bobby explains to dad how much homework he has.

Dad then asks Bobby whether he does any homework in school.

Richie continues to eat.

32'23" Richie continues to eat while his parents talk to Bobby about how much Bobby doesn't get done at school.

Richie gets out of his seat and walks to his mom and says, "My baby, my baby."

Eating Dinner[49]

Asking for Drink[51]

He stands by her.

He looks at the turkey.

Mom asks him whether he wants some turkey and tells him to "Go ahead" indicating that he could eat some.

In an unresponding manner, Richie walks away.

He points at mom and says, "Mommy, drink."

He picks up her drink.

Mom tells him to put the drink down.

[OC: It appears he was going to drink her drink. He may have stood next to his mom to initiate asking for a drink.]

He climbs into his chair from the side instead of pulling it out from the table to sit down.

The chair begins to wobble and dad holds the chair down to steady it.

He gets into the seat and sits on his feet.

33'27"He takes another bite of his noodles.

Richie continues to eat.

Mom and dad discuss with Bobby the different types of food Bobby likes.

Richie continues to eat, looking around the room, not appearing to be attending to the dinner conversation.

He glances around with a neutral expression.

He drops a little bit of spaghetti sauce on the table and licks it up.

He picks up a noodle and eats it.

Richie begins to pick at his food appearing to not really be interested in eating his dinner anymore.

Eating Dinner[49]

34'39" He takes another bite of food. He opens his mouth and puts his thumb inside. His mouth is open very wide. He removes his thumb then takes a drink of his mountain dew.

Grandpa walks into the kitchen and teasingly taps Bobby on the back of his head.

35'15" Acting as if bothered and also amused by the attention, Bobby tells his grandpa to stop.

Richie keeps on eating.

Grandpa leaves the kitchen.

Bobby comments that sometimes it is annoying that grandpa touches him. His parents tell Bobby that sometimes he does annoying things.

Richie continues to eat with neutral expression.

Grandpa walks into the kitchen again.

Richie looks at his food.

Responding to Grandpa[52]

Grandpa, shaking his fist in the air and with a smile on his face, says loudly to Richie, "Hey Miller, do you see this, do you see this?"

He repeats, "Do you see that Miller?" appearing to try to get more of a response from Richie.

Richie does not respond and watches his grandpa with mild interest.

Bobby teases his grandpa by saying something to him.

Richie continues to eat and look around. He watches his grandpa as grandpa gets a beer out of the refrigerator.

Richie takes a bite of food.

Failing to Respond[53]

Grandpa goes over to Richie and pretends like he is going to eat Richie's food.

Mom comments that Richie would not care and that grandpa could eat the whole thing.

Richie does not respond.

Eating Dinner[49]

36'42"Richie takes a drink of his soda.

A dog can be heard very loudly scratching the back door.

Dad talks to Bobby.

Richie begins to pound the table with his fist as if to get attention.

Mom says sternly, "Hey,hey."

Richie stops and goes back to drinking his mountain dew.

Richie takes another bite of pasta and playfully puts the pasta into his mouth.

37'38" Richie makes his fingers stick out in an unusual way.

He drops a noodle on his chair and picks it up.

Failing to Respond[54]

Richie belches.

Mom tells him to say,"Excuse me."

Richie does not respond.

Richie stands up and pushes his seat away.

He takes his soda and drinks it.

Mom asks him whether he is done.

Richie does not respond.

She repeats this.

38'18" Richie says,"Done with my spaghetti."

Mom tells him that he knows what to do.

Ignoring mom, Richie runs into the dining room.

Mom tells Richie loudly and firmly to come back here.

She tells him to put it in the garbage and then put his plate in the sink.

Putting Leftovers and Plate Away[55]

38'35" Richie repeats "Put it in the garbage" with a rising inflection at the end of the sentence.

He licks his fork and takes his plate to the garbage. He carefully throws the pasta that he did not eat into the trash.

Mom tells him that he did a good job and that he needs to put it in the sink.

Richie repeats, "Put it in the sink" exactly in the tone that mom said it.

Dad tells Richie to put it in there too.

Richie puts the plate in the sink and stands by the sink. He begins to watch the dishes as they sit in the water.

They tell him that he did a good job.

Richie does not respond to this praise.

Dad, mom, and Bobby are still eating.

Dad tells Richie to not play with the dishes.

Richie makes a noise as he watches the dishes.

Mom asks Richie to put another dish in the sink.

He takes the dish and places it in the sink.

Watching TV[56]

39'24" Richie excitedly runs out of the kitchen, through the dining room, and up the stairs.

The rest of the family stay in the kitchen eating.

Richie enters the living room upstairs and goes to watch tv.

He says, "Shrrooom" repeating what he heard on a tv commercial for 101 Dalmatians.

He sits on the couch watching the tv with great interest.

He repeats the phrase "give me" immediately after hearing it on the tv.

Playing Video Game[57]

While sitting on the couch, Richie picks up a virtual reality video game and places it up to his eyes. The game covers most of his face as he plays it. Music can be heard coming from the game.

[OC: Richie's mom told me that school personnel recommended this type of activity for Richie in order to improve his visual/motor skills.]

He plays with the game.

41'09" He continues to play the game with great interest. He makes noises as he plays the game appearing to be totally engrossed in the activity.

He continues to play the game.

41'55" He continues to play.

42'24" Suddenly, Richie puts the game down on the couch. He stands up and does a little dance. He turns around then goes back and sits down and picks up the game and plays with it some more. He is making much louder noises this time as he plays. The noises sound like something like he is clearing his throat. He also makes noises that sounds like he is shooting at a target.

42'48" He continues to play with the toy.

[Tape turned over]

43'21" He continues to play the game.

He suddenly stops, makes little screeching noises, dances to the music on the tv, and smiles. He looks very excited.

43'55" He is jumping up and down and making noises like he is shooting a gun. He puts his fingers again in the unusual crossed position. He jumps up and down again.

44'09" He goes back and looks at the video game and begins to play with it.

He puts the video game down, stands up, stomps and jumps up and down, and places his fingers in the unusual position. His arms flail back and forth.

45'12" He walks into his bedroom and looks around. While Richie appears to be looking for a toy, the video game can still be heard in the living playing the music that goes with it.

Playing with Toys[58]

Richie takes a bunch of toys without any facial expression and makes a shooting noise. He takes a transformer type toy that he tries to put onto another transformer. He has a very serious look on his face. The two transformer pieces go together to make a very large transformer. Once he puts the two pieces together, the toy falls apart onto the ground. He shows no sign of being upset and appears to have a neutral expression.

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Chronolog 2

Name: Trey
Age: 6 years, 10 months old
Diagnosis: Down syndrome
Grade: Kindergarten
School: Wilson Elementary
Time of Observation: Approximately 3:30 to 5:30
Observers Name: AF
Place: Home
Settings: Kitchen
Living Room and Dining Room
Bathroom
Bedroom
Upstairs Living Room
Upstairs Bedroom
Participants: Mom = Trey's mom
Dynna = Trey's 10-year-old sister
Name: Joe

[This is an excerpt from dinner time.]

Watching TV[8]

Eating Dinner[7]

Talking to Mom[19]

20:48 "Mommy I miss you" Trey says with a smile.

"Ahh yes" Trey's mother responds warmly.

"Wah wah wah, huh?" he responds to his mother by rattling on with nonsense noises.

He continues to diligently eat his food.

Trey looks away from the TV set and begins to look at the area where his mother is cooking. He begins to make clicking noises by snapping his tongue against the roof of his mouth.

21:28 He continues to cluck.

21:35 He stops clucking abruptly for no apparent reason.

21:57 He looks back at the TV, takes a large bite of the sandwich and begins chewing it.

Watching TV[8]

Eating Dinner[7]

Trying to Get Attention[20]

He takes another bite, gnawing on the sandwich, slowly watching the TV.

Meanwhile Trey's mother who has left the room a short while ago while Trey was staring at the TV reenters the room, but he does not react in anyway and continues to stare at the TV.

21:58 "Niya" [OC: A nickname for Dynna] he says in a sing-song fashion.

22:07 He looks over and says again "Niya" and holds up his hand as if he was trying to get Dynna's attention.

22:17 "Mama, mama" he beacons with his voice rising in the last syllable.

"Maaa maaa" he continues slowly dragging out the words.

Trey's sister begins to unwrap a package.

22:32 Trey glances towards his sister to see what she is doing [OC:Trey's sister is still unwrapping a package] as he continues to chew the sandwich slowly but vigorously.

Trey sister does not respond to Trey's glance.

He continues to stare at the TV. He picks up the sandwich and shakes it quickly with great vigor and then sets it down.

"Mmmm, mmm" he hums as he shakes the sandwich back and forth.

Trey sets his sandwich down and matter-a-factly picks up his plastic cup.

"More juice please" Trey politely says as he holds his plastic cup out to his mother who is standing in the kitchen area.

22:50 "Thank you." Trey says politely as his mother approaches with a juice container.

"Ice iya iya iya iya" he chants as he wiggles in his seat and holds on to the belt of the booster seat.

Dynna gets up and goes over to the refrigerator and begins to get ice for both Trey and her.

Eating Dinner[7]

23:40 He begins to stare at the TV again and his movements freeze as he stares at the TV "Niyna Niyna" Trey chants as Dynna fills up his cup with ice.

Dynna routinely hands the cup back to Trey.

24:11 He takes a drink from cup and continues to sip for the cup slowly.

24:29 He continues to drink slowly sucking on the lid of the cup.

24:40 He continues to drink as he slowly leans back in his chair resting on the back of the chair.

Calling to Mom[22]

He stops drinking and looks briefly away from the TV and says "mooom" and continues to hold the plastic cup in his hands.

When he gets no response from his mother who continues to work in the kitchen Trey looks back at the TV.

24:55 He lifts the cup up and continues to drink the contents slowly.

He begins to set the cup down, but stops midway and holds the cup suspended in space as he continue to stare at the TV.

25:09 He slowly drinks again.

25:17 He lackadaisically sets the mug down.

He then picks the cup back up and takes another few quick drinks holding the cup with his pinky extended.

25:20 He picks the mug up again.

He continues to sip the drink from the mug and to stare at the TV.

He sticks his tongue out slightly and silently making an "aaaah" motion with his mouth.

Trey stares blankly at the TV with his mouth agape.

25:49 Trey takes another sip from the mug [OC: Trey appears not to be fully conscious that he was drinking. He seems as if he was on remote pilot as he drank the juice and stared blankly at the TV].

He carefully sets the mug down again and scratches his neck absent-mindedly.

He picks up his sandwich without much enthusiasm and sticks it into his mouth.

26:12 Trey lets the sandwich hang in his mouth for a few seconds before regrabbing the sandwich with his hands and chomping vigorously on the crust of the sandwich.

26:29 Trey continues to eat the sandwich with gusto as he begins to wiggle in his seat.

Trey continues to stare rather blankly at the TV set and ignore his mother's and sister's presence. His mother has now sat down at the table and is eating her dinner as Dynna is finishing up her dinner.

26:46 He continues to chew fervently on the sandwich.

He continues to stare the TV, but he chewing is slowing.

27:33 He continues to stare the TV and chew with his mouth open; he wiggles slightly in his chair.

28:08 He continues to stare at the TV and chew on his sandwich.

He begins swinging his legs very slightly, occasionally kicking the lower crossbar of the chair he is sitting in.

28:59 He continues to chew on his sandwich and stare blankly at the TV set.

29:25 He casually tucks his feet inside the crossbar of his seat.

29:35 He slowly leans forward in his chair continuing to chew on the sandwich and stare at the TV.

He grabs the cup by the plastic mouth piece and then looks at the cup.

He looks inside the cup [OC: The cups is almost empty].

30:19 He takes a sip holding it up high as if he was trying to get the last few drops of liquid out of the cup.

Watching TV

Eating Dinner[7]

Asking for Juice[23]

Responding to Mom[24]

30:34 He sets the mug down and picks up a hand rag and coarsely uses it to wipe his mouth.

He then lays the rag vacantly on the table.

He shoves the cup as far as he can reach across the table towards the place where his mother is sitting.

30:57 He begs "Please, please, please." as he looks at his mother.

"Not now." his mother responds matter-a-factly.

"Please..." Trey continues without missing a beat.

Meanwhile Trey begins holding the top back of his chair.

"What do you me me..[second pause] Me? Me?" Trey babbles.

Trey unintentional burps.

Mrs. Beau responds immediately, asking "What?!"

" 'cuse me" Trey quietly responds.

31:22 Trey stops fiddling with the ladder back of the chair and casually picks up the sandwich again.

31:28 He takes a good sized bite and begins to chew again with his mouth open.

His mother hands him another sandwich which he touches and says "haaah."

31:47 "Please more, please" Trey begs as he extends his arm toward the cup which still is across the table He looks pleadingly at this mother.

Mrs. Beau says "this much" as she indicates using her thumb and index finger to show the amount of drink she give him. [OC: The amount is about 1 inch].

"Hah. hah ha ha, ho ho h ho ho..." Trey stammers excitedly in response.

"Do you want ice?" Trey's mother asks calmly.

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Eating Dinner[7]

Trey nods his head assuredly yes "Yes, yes" he declares.

He then puts all his dishes together in a pile and pushes all the dishes to the center of the table and wipes his hand with wet rag that is laying on the table nearby.

"I'm hot" Trey moans.

32:17 His mother asks him if he wants anything else.

When he shakes his head indicating that he does not, his mother says routinely "then you can get down."

Trey glances over at the TV and begins to stare at the TV.

32:46 Mrs. Beau continues by firmly saying "go."

Trey at the direction of his mother slowly gets out of the chair, absently unbuckling his seat belt and then slowly strolls over to the TV set, taking his cup with him.

Once Trey is in front of the TV he stops and continues to stare at the screen.

33:14 Trey continues to stare at the TV.

Drinking[25]

33:26 He slowly takes a drink from his cup, continuing to stare blankly at the TV set.

He remains standing frozen in place in front of the TV set.

33:37 He continues to hold the cup in his left hand as he sticks his right hand down the back of his pants.

Trey withdraws his hand for a few seconds and then absent-mindedly puts his hand again down the back of his pants.

He continues to stare at the TV as his mother asks him a mumbled question.

Trey does not respond, but continues to stare blankly at the TV screen.

Watching TV

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Appendix I: Activity Unit Coding Manual

Section I: Structural Categories

1. Length of AU

This category is the duration of the AU. This will be useful for comparing and summarizing data. Judge the duration to the nearest minute unless the AU lasted less than one minute in which case, judge as nearest to either 15 seconds, 30 seconds, 45 seconds. Record time as 1.00, 3.00, .25, .75, etc.

2. Type of overlap of AU

Code:

1 = Isolated (the AU occurred singly, without any overlap)
2 = Enclosing (the Au contains at east one entire other AU within it)
3 = Enclosed (the AU is itself completely contained by another AU)
4 = Interlinking (the AU occurred at least partially during the course of another AU and both AUs would be marked as interlinking)
6 = Interrupted (the AU is discontinuous)
9 = 2 and 4

3. Total number of overlapping episodes

Count the number of AUs which overlapped with the target AU (the one being rated) throughout its course. Enter zero (0) if no overlap.

Section II: Qualitative Categories

4. Initiation of the AU

This category refers to who or what began the AU.

Code:

1 = Self (the person whose behavior is being coded)
2 = Mom
3 = Sibling (brother, sister, etc.)
4 = Other adult
5 = Teacher
6 = Other child
7 = The environment (e.g., the dog tried to eat from Joe's plate)
8 = Other (any source of initiation not codeable above)
9 = CNJ (cannot judge, use when there is not enough information in the chronolog to assign initiation to one of the categories above)
10 = sibling and other child
11 = dad
12 = grandparent

5. Termination of the AU

This category identifies who or what ended the AU.

Code:

1 = Self (the person whose behavior is being coded)
2 = Mother (e.g., mom responded to child taking her hand, mom refused child's request)
3 = Sibling (brother, sister, etc.)
4 = Other adult

5 = Teacher
6 = Other child
7 = The environment (e.g., the dog tried to eat from Joe's plate)
8 = Other (any source of initiation not codeable above)
9 = CNJ (cannot judge, use when there is not enough information in the chronolog to assign initiation to one of the categories above)
10 = Sibling and other child
11 = dad
12 = observer - child initiated with observer, observer does not respond
13 = grandparent
14 = mom and dad

Note: If the child ignores another person, then the child terminated the interaction. Same as if mom responded to child, then mom terminated the interaction.

6. Expression of affect of the child in the AU

This category rates the child's emotional feeling tone during most of the course of the AU.

-3 -2 -1 0 +1 +2 +3

Code:

1.0 = -3.0 (person is wildly unhappy, screams, cries, moves rapidly and/or violently about, bites arm, hits self, throws self on ground)
1.5 = -2.5 (person is moderately unhappy but brief period of 1 are noted; bites self on arm briefly)
2.0 = -2.0 (person is moderately unhappy or distressed during the unit. May pout for a period of time, fuss, whine, etc.)
2.5 = -1.5 (person is mildly unhappy overall but brief periods of 2 are observed)
3.0 = -1.0 (person is mildly unhappy, frowns hits or briefly at the air as if in frustration, speaks in firm or stern tone, frustrated, etc.)
3.5 = -0.5 (person grimaces briefly; mostly neutral but brief periods of 3 are observed; shows frustration in tone of voice or in facial expression; person shows serious affect)
4.0 = 0.0 (Neutral, bland, matter-of-fact. No affect observable of either a positive or negative tone.)
4.5 = 0.5 (person smiles briefly; mostly neutral but brief periods of 5 are observed; speaks kindly or calmly)
5.0 = 1.0 (person is mildly happy or excited. Smiles or looks pleased; animated voices, "Happy noises".)
5.5 = 1.5 (person is mildly happy mostly but brief period of 6 are observed)
6.0 = 2.0 (person is moderately happy or excited. May clap hands and dance around, runs around and makes "happy noises")
6.5 = 2.5 (person is moderately happy overall but brief periods of 7 are observed)
7.0 = 3.0 (person is wildly happy or excited. Laughs loudly, claps, dances, hugs others. Whoops, screeches, etc.)
8.0 = Variable (person's affect changes substantially, 2 whole points or more, during the unit. many units will contain some smaller fluctuations in affect. This subcategory is reserved for considerable fluctuation. It is not intended, for example for use in a situation which is mostly negative and simply has a little final happy upturn at the end.
99 = cannot judge

7. Who is primary person involved?

1 =Mother
2 = Father
3 = Sibling

4 = Other adult
5 = Teacher
6 = Other child
7 = Other (any source of initiation not codeable above)
8 = CNJ (cannot judge, use when there is not enough information in the chronolog to assign initiation to one of the categories above)
10 = co-equal (two individuals are involved simultaneously and at similar level of duration)
11 = observer
12 = grandparent
99 = N/A

8. Who is secondary person involved?

1 =Mother
2 = Father
3 = Sibling
4 = Other adult
5 = Teacher
6 = Other child
7 = Other (any source of initiation not codeable above)
8 = CNJ (cannot judge, use when there is not enough information in the chronolog to assign initiation to one of the categories above)
10 = co-equal (two individuals are involved simultaneously and at similar level of duration)
11 = grandparent
99 = n/a

9. Expression of affect of the primary other person in the AU

This category rates the other person's emotional feeling tone during the AU.

-3 -2 -1 0 +1 +2 +3

Code: same as in number 6. Please see number 6 with one exception noted below.
99 = N/A (other person is not involved in AU)

10. Expression of affect of the secondary person in the AU

This category rates the other person's emotional feeling tone during the AU.

-3 -2 -1 0 +1 +2 +3

Code: same as in number 6. Please see number 6 with one exception noted below.
99 = N/A (other person is not involved in AU)

11. General Intent of AU from child's perspective

This category refers to the purposed goal of the AU **from the child's perspective**.
This category answers the question, "Why, or for what reason, did the activity occur?"

1 =To engage in interaction with others. Examples (a) include attracting attention to self. It appears that the purpose or reason for the initiation may be to purely attract another's attention (e.g., child grabs hair of another child to get attention, child calls out mom repeatedly without asking for anything, child taps sister's leg, or child touches mom's face; putting hand or feet on brother; taking mom's hand briefly, putting sister's hand on his shoulder, squeezing sister's hand, playing trick on dad at dinner); (b) responding to person(s). Child responds either positively or negatively (refusing to eat banana, trying to move away from mom) to a person. The child's psychological intent shifts in order to respond to another's greeting, question, comment, etc, that is in a different psychological direction. Also this code includes examples when child's intent is to

wave bye to dad, hugging a friend, going to the door to see dad, or chases mom when she initiates the play, and giving mon "five" after she initiates it and it is in a different psychological direction. Child could also meet this code if he responds to a suggestion of an activity from someone else (going outside to play when mom suggests this); (c) failing to Respond to person(s). Child does not interrupt his ongoing behavior stream or activity to respond to the direct question, greeting, etc of another person. It is clear that the person is directing his/her attention to the child and that the person expects a response from the child. No evidence is needed that the child understood what was being asked, asking for help/ permission to do something. Child cannot complete his goal independently and needs the help of someone to do so, e.g., asking for more drink or food, leading mom to the swing by her hand so she will push child. Child's intent seems to be for the purpose of getting help; asking a question (e.g., asking when dad will come and visit, asking mom when she's going to work, when is dinner, what is for dinner) Child's intent seems to get information that is either distinct and different from his ongoing activity or occurs independent of other behavior; and (d) giving Information.

2 = Readying the Environment. Examples include (a) cleaning up after self such as cleaning up after dinner, cleaning up plate, throwing away left-over food, cleaning up toys, putting homework away, putting belongings away; (b) preparing food or drink; and (c) organizing own materials. The child is performing an activity that relates to some routine, organizing papers, putting things in line, turning light bulbs so that they go off.

3= Playing or doing a past-time activity (riding bike, playing with rope, playing with keyboard, playing with child, carving pumpkins, drawing, jumping on bed, petting dog, feeding dog). Remember that watching tv is often a major activity of children and is coded in number 8. TV watching is different in that the child is being entertained by something rather than interacting physically with something.

4 = Doing Homework.

5 = To express affection. This code is used when the child shifts his psychological direction and for the mere goal to display affection (e.g., tell mom he loves her, giving mom a kiss, cuddling with mom).

6 = To move body. Examples include (a) pacing or walking about. Child appears to have not other goal but to pass time. This behavior may appear unfocused, but it occurs for a significant amount of time and is appropriate to the setting; and (b) putting stuff in mouth. Chewing on something.

7 = To maintain self. Examples include (a) going to bathroom; (b) resting or laying on bed; (c) cleaning self. Child washes his hands, wipes his face, getting nails trimmed, wiping sauce off self, dressing self, wiping nose, blowing nose, activities involved with general hygiene care etc.; and (d) making self more comfortable. Child performs some behavior with the intent to relieve self in some way, such as taking aspirin, taking clothes off, standing in front of fan.

8 = Eating and Drinking. Units that are marked because the child is on his way to drink or eat are coded here (moving chair to the table).

9 = To Engage in Ritual. Examples include (a) standing in corner. Child is told to go to time-out and goes; and (b) saying grace.

10 = To Engage in Idiosyncratic Behavior. The child's behavior is idiosyncratic and atypical. The behavior is also inconsistent with the ongoing behavior setting or primary AU. (e.g., pacing around the house, walking in circle, chastising self, fiddling with pizza roll, putting pizza roll on head, holding glass of mountain dew to light and looking through glass, picking toe, putting hands

in pants) There appears to be a purpose, but the purpose is difficult to interpret. Also, the behavior would be considered a inappropriate for the setting based on the perspective of the average person.

11 = Watching TV or asking to watch TV, changing tapes for VCR. Any activity related to the goal of watching TV.

12 = To examine something. For example, (a) examining something in the environment. Something catches the child's attention and the child briefly attends to the object and then resumes other activity. Child may passively react to the object by looking (looking at brother's baseball card, candy, under brick, or at sausage) or may actively react to the object (batting at a fly while eating dinner, running to TV when favorite cartoon is heard, crying when bug lands on leg, responding excitedly when child sees dog); (b) Watching person(s). Someone catches the child's attention and the child attends to the person. The child's intent seems to be focused on the other person and occurs for a significant amount of time. If the child is eating dinner and continuously looks around at the people eating, this is part of eating dinner and not coded separately, However, if the child is performing some activity and pauses to observe a person, which is not part of the ongoing activity, then code this. (e.g., watching mom intently as she cleans the dinner table, looking at family perform activities); and (c) Noticing observer. Child approaches observer, touches observer, talks to observer or performs some behavior that is more than a mere glance at the observer.

13. To find something. (looking in freezer, looking around in the kitchen, looking for paper). Child's goal appears to be unmet. The child shows clear behavioral evidence that he is looking for something.

99. Cannot judge. The child's intent is unclear because the behaviors are vague and diffuse

12. Mechanisms used by child to accomplish the goal of the AU

This category described what means were used by the child to implement the goal. Remember this is the PRIMARY method the child uses to complete the AU. If other Aus occur simultaneously, focus on the behavior displayed to completed the primary AU being coded. For example, if the child is watching TV and the AU being coded is "watching TV" and mom comes into the living room and asks the child to go wash his hands, focus on the behaviors used during watching TV. Some children watch TV and interact with the TV by labeling what they see on the screen, these children use verbal means to watch TV in addition to watching. Also, some children point at the screen and use gestures as well.

Code:
0 = child failed to respond (use this code in conjunction with fail- ? to respond used in code 11)
1 = verbal (clear words and sentences)
2 = gesture or signal (showing, pointing, waving, nodding, shrugs, ...)
3 = physical: physical contact (touching shoulder, tapping head, grabbing arm briefly, pushing, kissing, tickling) physical assistance (hand-over-hand help during homework; leading mom to swing, being swung by mom, physical guidance, helping on swing), walking, running, jumping, dancing, laying, sitting, etc., moving fingers or hand (play keyboard, moving, writing homework, turning on tv, handing object to someone) **This code can be used for almost all units, thus it should be reserved when this is the primary mechanism**
4 = visual or picture (communication board; homework; using a visual prompt) Do not confuse with concrete object. When mom, for example, shows child milk jug and soda can, she is using concrete objects not pictures or communication board.
5 = watching/observing/looking
6 = self-injury
7 = other (self-stim) motor stereotypy (fiddling with object or flapping own body part)
8 = vocalizations (unintelligible words or sounds, grunts) proximity (standing next to)

13. Mechanisms used by primary partner in AU

See above category for codes
99 = not applicable/ other person not involved

14. Mechanisms used by secondary partners?

See above category for codes
99 = not applicable/ other person not involved

15. Intensity of effort of child in the AU

This describes the level of intensity or the amount of effort of child in the AU.
This category assesses the **attention, energy, and involvement** of the child in the AU.

1	2	3	4	5
little				high

1 = a small amount of energy is put forth or a low level of effort is observed, child's attention is low, and his involvement is small (child appears casual and laid back; lackadaisical)
2 = between 1 and 3 (person may show small level of attention, but doesn't exert much energy)
3 = a medium amount of effort is put forth (child pays attention, calls to mom, and exerts energy and is involved a moderate amount)
4 = between 3 and 5
5 = a considerable amount of effort is put forth (child shoes a high level of attention, energy, and involvement. Child appears very intense; being constantly physically involved within AU)
0 = child did not respond
6 = mixed (effort varies from small to considerable within the AU)
9 = CNJ (cannot judge)

16. Intensity of effort of primary person in the AU
This describes the level of intensity or the amount of effort of person in the AU.
Use code descriptions listed in number 15.
99 = N/A, observer

17. Intensity of effort of secondary person?
See above

18. Setting
1 = structured (the activity is highly organized by the parent; dinnertime, homework, chores, being washed or groomed)
2 = unstructured (free time, play)

19. Sociality of AU
1. Complex Social: more than one person involved
2. Simple Social: one other person is involved
3. Potentially Social: other people present but not involved
4. Nonsocial: no one present

20. What is the duration of other's involvement?
Estimate the percentage of time other person or people are involved with child throughout entire AU.

1 = low (<20% of duration of AU)
2 = moderately low (20-40% of duration of AU)
3 = moderately (40 - 60%)
4 = moderately high (60 - 80%)
5 = high (80 - 100%)
9 = N/A, observer

21. What is the continuity of primary person's involvement?
1 = person is involved intermittently
2 = person is involved continuously
3 = person is involved in one aspect of AU continuously but not throughout the AU (at beginning, middle, or end)
4 = beginning and end of AU
9 = N/A, observer

22. Was the Child's Goal Achieved?
Remember to ask whether, from the child's perspective, his goal was completed. If the parent told the child to wash his hands and he does, even though he shows some effort to protest, he is judged as completing the goal.

0 = no (parent stopped child's behavior or parent did not respond to the child)
1 = yes
2 = cannot judge, the goal of the behavior was too vague

23. How difficult was it to judge the child's purpose in the AU?
1 = not at all
2 = somewhat difficult
3 = moderately difficult
4 = extremely difficulty

Appendix J: Training Protocol for Observers, Unitizers, and Coders

Observer Training

The training protocol described in (Bowman, 1980) was used to meet the needs of the research objectives. The observers were trained to collect chronolog records that provided: (a) an acceptable level of behavioral descriptions at the molar level, (b) an acceptable level of low inference descriptions, and (c) a time-line reference. Observations were recorded with the use of a Stenomask in the home settings. Previous ecological articles and studies (e.g., Barker & Wright, 1963; Dyck, 1963; Scott, 1977,1980) and available chronolog records (e.g., from P660, Ecological Psychology) were provided to the observers. Once the observers read these works and became oriented to ecological methods using the stenomask, they collected a chronolog. Before data collection, they were given a demonstration of the equipment and asked to assemble, operate, disassemble, and maintain the equipment.

The observers first collected a 10-minute chronolog record. The level of behavior which was recorded, the amount of inference applied, the type of language used, and the format of the record were examined. Once a satisfactory record was produced, the observers collected a 30-minute chronolog record. Again the same criteria were used to inspect and correct the chronolog. The procedures followed a match-to-sample model. Each observer was required to produce a satisfactory record at each step. Once this was accomplished, the orientation and adaptation procedures were implemented in the homes of the children. The record that was collected during adaptation was reviewed by the observers and the trainer. Problems were identified and corrected. Once the objectives of observer training were met, the observers were deemed to be competent.

Unitizer Training

This training provided the unitizers with the skills to correctly identify and mark the two ecologically meaningful units relevant the research, activity units (AUs) were judged as needing to meet a minimum reliability criterion of 80%. The unitizers were referred again to the ecological articles and studies described previously. They met with the trainer to discuss any questions or confusing aspects of the units and then were introduced to the procedures below (from Bowman, 1980):

1. They reviewed the definition of the unit and the rules for marking the record.

2. They read the entire record to get an overview of what the subject was doing, making mental notes of where the major, natural breaks in the subject's behavior fall.

3. They returned to the beginning of the records and ask, "What did the subject think he or she was doing," then started to identify and mark the units.

   They tried to identify major units first, and then go back to find minor units. If in doubt about whether a minor segment is itself a contained or enclosed unit or simply part of a larger unit, they tested the definition. One rule of thumb was that there may rarely if ever be more than three units proceeding simultaneously.

4. As they worked, they continued reading a page or two ahead in the record.

5. They marked each unit by drawing a tick mark at the start and at the end, and then connecting the tick marks.

6. They numbered the units on the record in the order in which they began.

7. As appropriate, they labeled each unit with a descriptive, participial phrase in everyday language. For example, "filling the dishwasher," or "talking to mom" are acceptable labels.

8. They compared their work with that of another unitizer, and determined inter-unitizer agreement by using the formula:

$$P = 100 \times \frac{(Axy_1Bxy_1) + (Axy_2Bxy_2) + \ldots(Axy_nBxy_n)}{[(Axy_1Bxy_1) + (Axy_2Bxy_2) + \ldots(Axy_nBxy_n)] + [(D_1B_1) + (D_2B_2) + \ldots(D_nB_n)]}$$

   Axy = units marked by both x and y independent analysts

   D = units marked by analyst x or y, but not by both

   B = time weight in minutes or fractions of minutes

9. They reconciled any differences in the identification of the units, and then mark the units on the final record.

The unitizers used this protocol to begin a series of practice sessions. During each session, unitizers followed the procedures and marked the AUs using a sample chronolog. The unitizers met to discuss problems and determine reliability. It was estimated that the unitizers needed 3 to 5 practice sessions in order to meet the criterion.

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Categorizer Training

The aim of this training was to teach the categorizers to (a) use the coding instructions for analysis of the AUs, (b) record their judgements using a coding form, and (c) achieve a inter-rater reliability of .80 to .90. The researcher and the categorizers met to review the research questions and to discuss why the parameters of behaviors represented by the rating scales were relevant to the study. The categorizers received the AU Codebook. They were asked to read the codebooks and ask questions. Issues that arose during coding were discussed. Sample records were provided as a means to practice using the codebooks. Once the categorizers met the criterion, they were judged as competent.

VITA

Lisa A. Ruble was born in Connersville, Indiana on November 27, 1962. Her family moved to Shelbyville, Indiana where she attended public elementary school until the 4th grade. In 1972, she moved to Indianapolis, Indiana and attended Sanders Elementary School and South Wayne Junior High School. She graduated from Ben Davis High School in 1981, subsequently attending Indiana University. Lisa graduated with a B.S. degree in Biology in 1985 and moved to Kalamazoo, Michigan to work as a microbiologist at the Upjohn Company. In 1988, Lisa gave up her position at Upjohn to pursue graduate work in psychology. She entered the Master's Program in Rehabilitation Psychology at Purdue University and worked as an intern at the Indiana Resource Center for Autism under the supervision of Nancy Dalrymple. Following a strong personal interest in autism, Lisa took a full time position at IRCA after her graduation in 1992. In the Fall of 1992, Lisa entered the doctoral program in Educational Psychology. She received a scholarship from the national Autism Society of America and a U.S. Department of Education grant for her dissertation research. In 1996, following a year long internship at the University of Minnesota Medical School in Minneapolis, Minnesota, Lisa moved to St. Louis, Missouri where she worked as a school psychologist while completing her PhD. In July of 1997, she received a faculty appointment at the University of Louisville, School of Medicine, Department of Pediatrics.